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BACKGROUND INFORMATION FOR STANDARDS OF PERFORMANCE: ELECTRIC SUBMERGED ARC FURNACES FOR PRODUCTION OF FERROALLOYS

VOLUME 3: SUPPLEMENTAL INFORMATION

ENVIRONMENTAL PROTECTION AGENCY

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This volume is the third in a series of background information on standards of performance for electric submerged arc furnaces for production of ferroalloys. The volume contains: (1) supplemental information on the basis for the mass standards of performance, (2) a summary of the issues on the proposed standards and EPA's responses, and (3) a reevaluation of the opacity standard with regard to recent revisions to the opacity method (Reference Method 9 of Appendix A to 40 CFR Part 60).

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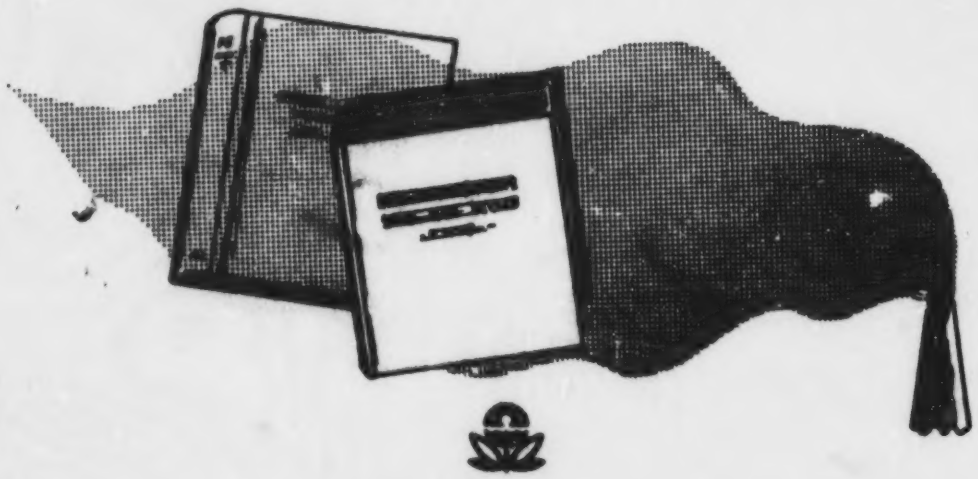

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Office of Air and Waste Management
Office of Air Quality Planning and Standards
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Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

April 1976

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I. Introduction

On October 21, 1974 (39 FR 37470), the Environmental Protection Agency proposed standards of performance for new ferroalloy production facilities. At that time, EPA made available to the public detailed information on the bases for the standards in "Background Information for Standards of Performance: Electric Submerged-Arc Furnaces for Production of Ferroalloys," EPA-450/2-74-018a and b (October 1974). Copies of the document may be obtained upon written request from the Emission Standards and Engineering Division, Environmental Protection Agency, Research Triangle Park, North Carolina 27711, Attention: Mr. Don R. Goodwin.

This report, which provides supplemental information on the standards of performance, is being issued in conjunction with promulgation of the regulation and discusses the issues associated with the final rulemaking action. As a result of comments on the proposed standards, the issue of the achievability of the standard limiting emissions from chrome and manganese alloy production to 0.23 kg/MW-hr (0.51 lb/MW-hr) arose and resulted in EPA's reevaluation of the bases for each of the mass standards of performance. Chapters II and IV contain a discussion of the results of the reevaluation including a consideration of alternative emission test procedures for demonstrating compliance of open, pressure fabric filter collectors. Chapter II also contains additional emission test data for well-controlled facilities. The emission data obtained after proposal of the standards are presented in Appendix A.

On November 12, 1974 (39 FR 39872), EPA revised the general provisions applicable to standards of performance and Reference Method 9, the test method for determining compliance with opacity standards. The standards of performance for ferroalloy production facilities were proposed before Reference Method 9 was revised. Accordingly, EPA reevaluated the opacity standard to determine the appropriate level of the standard consistent with the changes in Method 9. A discussion of the November 12, 1974, revisions and the reevaluation of the ferroalloy opacity standard is in Chapter III.

A summary of updated control costs is presented in Chapter V, and a summary of public comments and EPA's responses to them is in Chapter VI. Eighteen comment letters on the proposed standards of performance were received and considered. Also, appropriate Federal agencies and departments were consulted prior to publication of the final standards of performance, as required by section 117(f) of the Clean Air Act. All comments received were helpful in pointing out problems with the proposed standards and defining areas where a better explanation of the bases for the provision was necessary.

II. Mass Standards

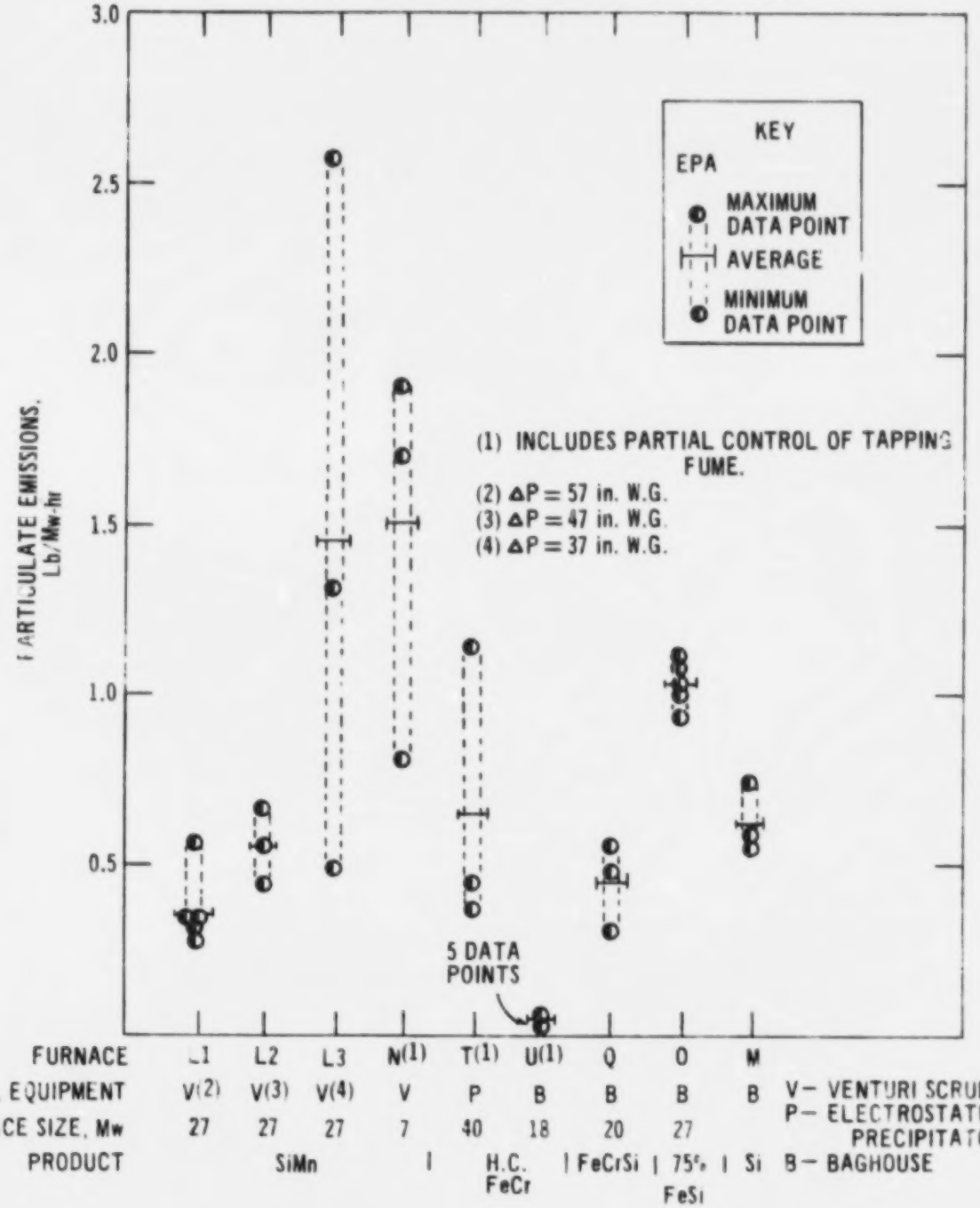
A. Rationale for proposed standards.

The proposed mass standards of performance for ferroalloy production facilities were based on a study of the operations, emissions, and control techniques of the industry and the measured emission rates from well-controlled facilities. As a result of the study, EPA determined that the best system of emission reduction (considering costs) for open furnaces is a well-designed fume capture hood that minimizes the induced air volume and a well-designed fabric filter collector or high-energy venturi scrubber. In EPA's judgment the emission limitations achievable by the best systems of emission reduction are 0.45 kg/MW-hr (0.99 lb/MW-hr) for high silicon alloys and 0.23 kg/ MW-hr (0.51 lb/MW-hr) for chrome and manganese alloys. The bases for the selected emission limitations are discussed below.

In the study of the industry prior to proposal of the standards, EPA conducted emission tests on seven open electric submerged arc furnaces, two of which were controlled by closed pressure fabric filter collectors, two by open pressure fabric filter collectors, two by venturi scrubbers, and one by an electrostatic precipitator. The emission rates determined for these seven facilities are shown in Figure II-1 which is reproduced from the report on this study.* Emissions in excess of the standards were reported only at facilities which had either improperly maintained the control system or used systems

*Background Information for Standards of Performance: Electric Submerged Arc Furnaces for Production of Ferroalloys, EPA-450/2-74-018a and b.

FIGURE XI-I
PARTICULATE EMISSIONS FROM OPEN ELECTRIC SUBMERGED-ARC FURNACES PRODUCING FERROALLOYS


3.0
2.5
2.0
1.5
1.0
0.5
PARTICULATE EMISSIONS, Lb/Mw-hr
KEY
EPA
MAXIMUM DATA POINT
AVERAGE
MINIMUM DATA POINT
(1) INCLUDES PARTIAL CONTROL OF TAPPING FUME.
(2) ΔP = 57 in. W.G.
(3) ΔP = 47 in. W.G.
(4) ΔP = 37 in. W.G.
5 DATA POINTS
FURNACE L1 L2 L3 N(1) T(1) U(1) Q O M
CONTROL EQUIPMENT V(2) V(3) V(4) V P B B B B
FURNACE SIZE, Mw 27 27 27 7 40 18 20 27
PRODUCT SiMn | H.C. FeCr | FeCrSi | 75% FeSi | Si
V— VENTURI SCRUBBER
P— ELECTROSTATIC PRECIPITATOR
B— BAGHOUSE

other than the best system of emission reduction. That is, at the time of the emission tests, facility N had an inadequately designed scrubber; facility O had patched, leaky bags in the fabric filter collector; and facility T's control system, an electrostatic precipitator alone, was not representative of the best system of emission reduction. The emission rates for the seven facilities generally do not reflect control of tapping fumes. Emission rates which included tapping fumes could not be measured because no facilities with both effective tapping fume collection and an independent control system amenable to emission measurements could be located at the time of the study. Accordingly, calculation methods were used to determine the equivalent emissions from a furnace with effective capture and control of tapping fumes. The calculation procedure was based on measured uncontrolled emission rates for tapping, an assumption of 100 percent capture of tapping fumes, and a control device with a 99 percent collection efficiency. Using a conservatively high value of 68 kg/hr (150 lb/hr) of uncontrolled tapping fumes, the effect of including tapping fumes from a 30 MW furnace tapped for 15 minutes over a furnace cycle period of 75 minutes would be an increase in the emission rate of 0.0045 kg/MW-hr (0.01 lb/MW-hr). From the evaluation of the test data, the control systems, and the effect of tapping fume control, EPA determined that emissions from a well-controlled open furnace producing silicon metal or 75 percent ferrosilicon can be controlled to less than 0.45 kg/MW-hr (0.99 lb/MW-hr) and emissions from a well-controlled open furnace producing high carbon ferrochrome, silicomanganese, or

ferrochrome silicon can be controlled to less than 0.23 kg/MW-hr (0.51 lb/MW-hr).

The emission limitations require that the gas volume treated by the control device be limited. Gas volumes from open furnaces vary with product and hood design because of differences in the volatility of the furnace charge materials, differences in the quantity of gaseous by-products of the carbothermal smelting process, differences in furnace capacity (diameter), and differences in the opening between the furnace and the hood. As typically designed in the U. S., an open furnace has a water-cooled canopy hood located about 1.5 to 2.5 meters (5 to 8 feet) above the furnace crucible rim. The large vertical opening between the furnace crucible and the hood permits large quantities of induced air to be drawn into the emission collection system and may dilute the gases produced in the furnace by as much as 50 to 1. Typical gas volumes from open furnaces hooded in this manner vary from 50 to 190 standard cubic meters per second (scms) [100,000 to 400,000 standard cubic feet per minute (scfm)]. The volume of induced air can be reduced by decreasing the size of the opening between the furnace crucible and the hood. Demonstrated methods of reducing the quantity of induced air include: (1) positioning the hood closer to the furnace, (2) enclosing the area between the furnace and the hood with refractory-lined or water-cooled doors or with chain curtains, and (3) air curtains. These methods are in routine use at ferroalloy production facilities in the U. S. and in foreign countries.[1,2] By emphasizing reduction of gas volumes during design of the furnace hood, the air volume requiring treatment by the control device can be

substantially reduced, and the standards can be easily met. However, results of EPA tests at two facilities with furnace hoods not specifically designed to minimize induced air volumes showed that their emissions could be controlled to levels below the applicable standards.

On the basis of a thorough evaluation of the emission data and information from the engineering study, EPA proposed standards of performance applicable to all the major silicon, chrome, and manganese alloys based on emission data for five of the alloys. The study of the ferroalloy industry revealed that although emission rates from uncontrolled furnaces can vary greatly among alloys, similar alloys often have similar levels of controlled emissions from a given type of furnace. Thus, standards of performance applicable to groups of ferroalloys were developed and proposed. Each group of ferroalloys consists of alloys having similar controlled emission rates and control equipment. This similarity in emissions of products within an alloy group is shown by the common practice in the industry of combining emissions from several similar alloys and controlling by a single complex of control devices.

B. Comments on achievability of standards.

Commenters on the achievability of the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard expressed concerns in two main areas. First, the commenters questioned the representativeness of the data used to demonstrate the achievability of the standard. Specifically, the commenters were concerned that sampling of only a limited number of compartments or control devices serving a facility, nonisokinetic sampling, and the procedures used to determine the total gas volume flow from open fabric

filter collectors would bias the data. As additional support for their position, the commenters also claimed that control equipment vendors will not guarantee that their equipment will achieve 0.23 kg/MW-hr (0.51 kg/MW-hr). The second area of concern to the commenters was expressed by their opinion that use of fine ores as charge materials will increase the furnace emission rate and preclude achieving the standard. For these reasons, the commenters argued that the standard of performance should be promulgated as 0.45 kg/MW-hr (0.99 lb/MW-hr) for all alloys. In EPA's opinion, a standard of 0.45 kg/MW-hr (0.99 lb/MW-hr) would allow installation of systems other than best systems of emission reduction. The bases for this conclusion are discussed below.

1. Representativeness of area sampled.

In the tests on facilities O and U, emissions were sampled in one of the three stacks discharging the effluent from the baghouse while total flow rate from the facility was monitored. The mass emission rates (kg/hr) of these facilities were calculated assuming the effluent concentration was the same in all three stacks. Similarly, emissions from facility M are based on the test results for one of three collectors and total flow from the complex of three fabric filter collectors. The commenter argued that these assumptions are not appropriate because standards of performance should be based on actual, accurate measurements.

EPA tests, and allows testing of, a representative number of stacks on or compartments in a control device because subsections of a properly operating control system should perform equivalently. The procedures used at facilities O and U were reasonable because the other sections of the control system were of equivalent design and in

equivalent or better operating condition to that of the tested section. The operating conditions of these two facilities were such that there was no reason to believe that the performance of any section of the device would be significantly different. The procedure used in determining the emission rate from facility M also did not result in emission data prejudicial to industry. The malfunctioning sections were shut off, and the tested collector was cleaning a greater than normal proportion of the total gas volume flow. Thus, the concentration of the emissions possibly was greater than during periods of proper operation of fabric filter collector.

In addition to possible variations in performance of sections of the control device, the commenter was also concerned that different sections of the control device would experience a different inlet particulate loading. For control systems on electric submerged arc furnaces, this should not be a problem assuming proper distribution of the inlet gas stream to the control devices. Particulate matter emissions from well-controlled electric submerged arc furnaces are known to consist of particles of less than two micrometers diameter.[3,4,5] Particles of this size do not have appreciable inertia, hence, they follow the motion of the gas stream. Accordingly, there will not be any size segregation of the particulate matter as it travels from the furnace to the control devices. Although the confidence in the data would be slightly improved by measuring from all stacks of a control device or all compartments of a fabric filter collector, there would be a significant

increase in the cost of emission testing and determination of compliance with the standards of performance. EPA does not believe that this added degree of confidence in the data is sufficient to justify the increased costs.

2. Anisokinetic sampling.

The commenter noted that EPA was inconsistent in its acceptance of emission test data obtained under nonisokinetic sampling conditions. Specifically, the commenter observed that EPA did not use results from runs conducted nonisokinetically at facilities amenable to testing according to Method 5, but EPA did use data obtained nonisokinetically at two open fabric filter controlled facilities. The commenter contended that the standards should not be based on emission data obtained nonisokinetically since the results do not represent the true emission level of the facility.

The objective of Reference Method 5 is to establish a uniform procedure for determining particulate matter emissions with maximum accuracy and precision under a variety of conditions. There are aspects of the method which, subject to engineering judgment, can be considered flexible in certain cases without sacrificing the reliability of the test results. Thus, understanding the reasons, and justifications, for the apparent inconsistencies in the data reduction and test procedures employed requires understanding the reasons for the requirements in the method.

Reference Method 5 specifies criteria for the velocity of a sample collection (sampling velocities must equal the gas stream velocities

within a specified error*) to ensure collection of a representative sample of the particles suspended in the moving gas stream. The errors in measured concentrations determined under conditions of nonisokinetic sampling are due to the inertia of heavier particles. That is, if the velocity in the sampling nozzle is greater than the gas stream velocity, a convergent gas stream will develop at the nozzle, and a greater amount of the lighter particles will be collected. Particles possessing sufficient inertia will not converge into the nozzle and will not be collected. Conversely, if the velocity in the nozzle is less than the gas stream velocity, part of the approaching gas stream is deflected and does not enter the probe. The heavier particles continue into the probe, resulting in an overestimation of the concentration. Analysis of the bias resulting from nonisokinetic sampling of particles has shown that for particles with aerodynamic diameters of five micrometers diameter or less, and for sampling at extremely low velocities, the error is insignificant and isokinetic sampling is not necessary.[6,7] That is, a reasonably representative sample of particles of less than five micrometers diameter can be obtained by nonisokinetic sampling.

Sampling of particulate matter emissions in well-defined flows, such as those found in stacks, can be conducted isokinetically and the resultant sample concentration will be representative of the effluent concentration. Emission tests by EPA on well-controlled facilities which discharge emissions through stacks were conducted in accordance

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*Sampling at nozzle velocities equal to the gas stream velocity is a condition known as isokinetic sampling.

with the procedures of Method 5. As specified by Method 5, data from runs conducted at sampling rates outside the range $90 \leq I \geq 110$ percent were not used as part of the bases for the standards of performance. Analysis of the variance of the nonisokinetic sample concentrations from the mean test results shows no statistically significant difference in the two groups of data. Thus, consideration of only isokinetic data was not strictly necessary.

Emissions from open pressure fabric filter collectors cannot be sampled strictly according to the criteria of reference methods currently in Appendix A of 40 CFR Part 60. The effluent from pressurized fabric filter collectors is discharged at low velocities from large areas. Consequently, isokinetic sampling is difficult using existing equipment and procedures of Reference Method 5. For this reason, in the tests of open pressure fabric filter collectors conducted by EPA, the criteria regarding the relative velocity of sample collection could not be followed and alternative approaches were used to sample emissions from the specific facilities.

The only ideal alternative to emission testing using modified Method 5 procedures was to prohibit use of open fabric filter collectors because of the inability to evaluate their performance. Factors such as significantly lower installation costs and ease of identification and replacement of leaking bags make open fabric filter collectors superior to closed. Such practical considerations supported avoiding the loss of an effective control system not amenable to sampling using Reference Method 5. For these reasons, provisions were established in §60.266(d) of the regulation to require construction

of the control device to allow measurement of emissions and flow rates using applicable test methods and procedures. This section permits the use of open fabric filter collectors (or other control devices) if compliance can be demonstrated by an alternative test procedure. Under the provisions of 40 CFR 60.8(b), the owner or operator of an affected facility may upon approval by the EPA Administrator show compliance with the standards by an "alternative" procedure. Thus, the approach taken by EPA in emission testing of open fabric filter collectors is not prejudicial to the source and allows use of systems that would otherwise be prohibited.

In EPA's judgment, it is possible to representatively measure emissions from open fabric filter collectors by nonisokinetic sampling if the effluent does not contain large particles such as would result from leaky or torn bags. Emissions from well-controlled ferroalloy furnaces were shown in the joint EPA-Ferroalloy Association "Engineering and Cost Study of the Ferroalloy Industry" (EPA-450/2-74-008)[3] to consist of particles of less than two micrometers aerodynamic diameter for all alloys. These data are consistent with size distribution data reported in other studies[4,5] and expected size distributions of aerosols formed by condensation. The mass and, hence, inertia of these particles are negligible. Thus, sampling of this metal oxide fume at superisokinetic or subisokinetic rates is not expected to significantly bias the measured concentration from the actual effluent concentration. Figure II-2 shows the relationship of sample validity to nozzle and gas stream flow conditions. Examination of Figure II-2 shows that sampling of

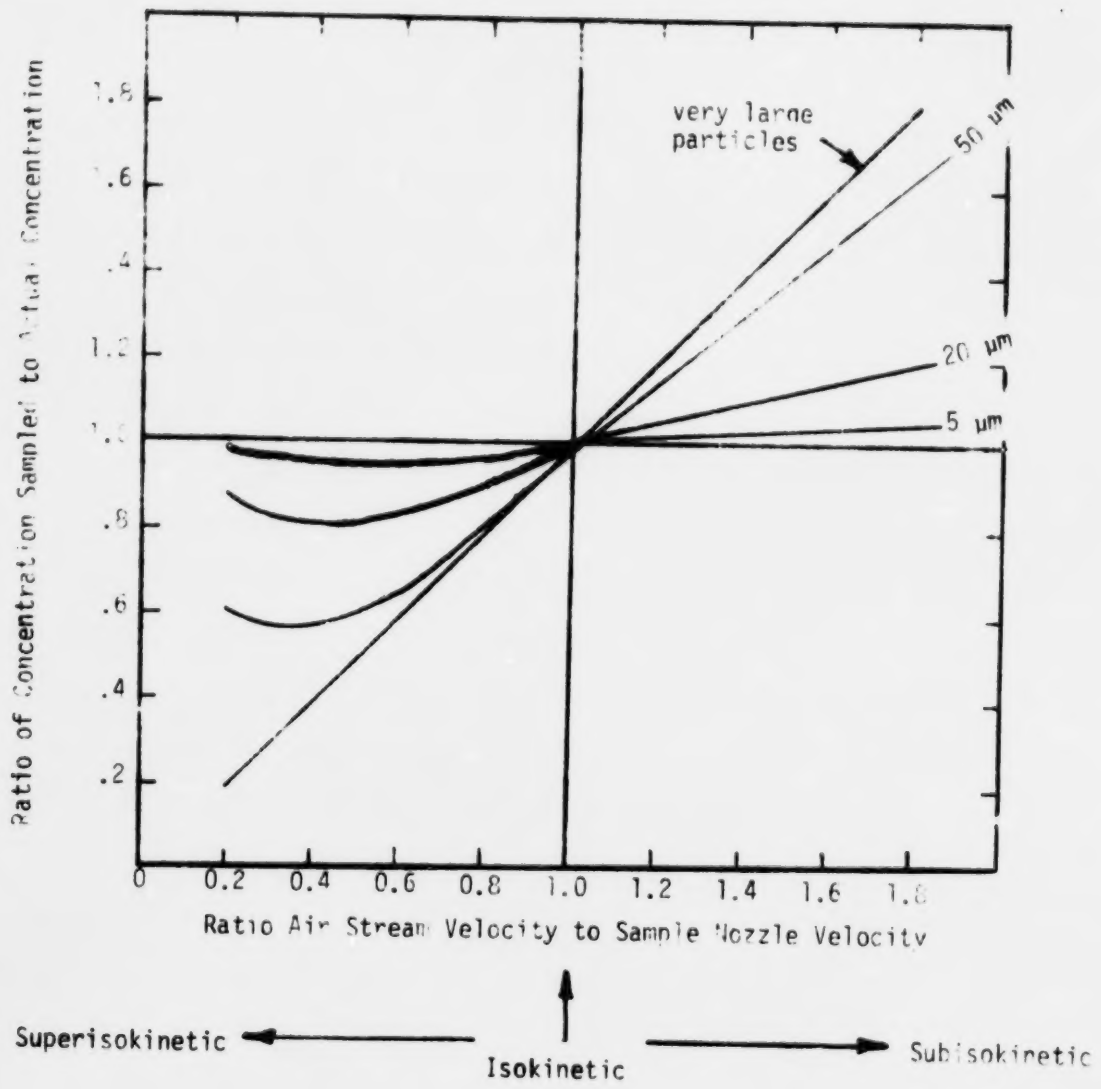


Figure II-2. Effect of Nonisokinetic Sampling on Measured Sample Concentration

particles of less than five micrometers aerodynamic diameter at non-isokinetic rates results in deviations from the true concentration of less than five percent. For the above reasons, EPA does not believe that superisokinetic sampling of emissions from properly operating fabric filter collectors would result in measured concentrations significantly lower than the actual concentration in the effluent. The reported concentrations of effluent for facilities M and Q are considered to be representative of the actual concentrations.

3. Flowrate determinations.

As part of an overall concern with the representativeness of the test data, the commenter questioned the validity of the procedures used to determine the total volume flow from open fabric filter collectors and the validity of the mass emission rate. Specifically, the commenter argued that the use of induced flows measured on one day to calculate the total gas volume flow on another day does not give an accurate assessment of the mass emissions from facility M. In response to this part of the comment on the achievability of the standards of performance, EPA reassessed the representativeness of the calculated total gas volume flow for the open fabric filter collector and concluded that it was sufficient to adequately determine the mass emission rate of the facility.

Pressurized fabric filter collectors used by the ferroalloy industry in the U. S. generally exhaust the gases through a roof monitor(s) or an open roof. There are open grates at the bottom of the collector (at the cell plate) to provide cooling of the gases

and bags by natural convection. The presence of this dilution air added after the bags complicates measurements of the mass emission rate from this type of collector.

The mass emission rate from open fabric filter collectors can be determined from measurements of the concentration and the average velocity in the discharge area or from measurements of concentration, inlet gas volume, and the induced air volume. For facility M, EPA calculated the total volume flow rate from the collector from measurements of the inlet gas volume flow and the flow rate of air induced into the baghouse. In this test the inlet gas volumes were measured during each run, but the volume of air induced into the collector was measured once during the period of the emission test. The total gas flow reported for facility M's test runs was the sum of the inlet gas volume for the run and the induced air volume.

Although the procedure used for determining the total gas volume flow was not ideal, the reported gas volumes are considered to be reasonably representative of the actual total gas flow rate. The basis for this conclusion is that the quantity of cooling air induced around the bags in an open collector is primarily dependent on the temperature of the inlet gas stream and the ambient air. Therefore, equivalent air volumes will be drawn into the collector under similar meteorological and inlet conditions. During the period of emission testing at facility M the meteorological conditions and inlet gas temperatures were fairly uniform and, thus, the volume of induced air was expected to be constant. Consequently, measurement of induced air volumes once during the test was expected to provide an adequate

estimate for calculation of the total volume flow from the facility.

Since conducting this test EPA has gained additional experience and has concluded that, in general, it is preferable to measure the total gas volume flow during each run of a performance test. This conclusion, however, does not invalidate the use of test data obtained at facility M because calculation of gas volumes from temperature data show that the original assumptions were valid. Calculation of induced air volumes from enthalpy balances using the reported inlet and ambient temperatures results in estimates of gas volumes which are consistent with the measured volumes. The volumes were calculated assuming adiabatic mixing (no heat loss) and, hence, perhaps may represent conservatively high values. The calculated and measured dilution air volumes and the total volume flow from the collector are shown in Table II-1. For facility M at the time of the emission testing, the induced air represents a small portion of the total flow; consequently, small fluctuations do not significantly affect the reliability of the total volume flow rate value.

The validity of the assumption of relatively stable induced air flow rates is also shown by calculations of the effects of ambient temperature fluctuations on induced air volumes and total gas flow from the collector. During the period of emission testing at facility M, the ambient temperatures fluctuated less than 6 ^{o}K (10^{o}F). Using enthalpy balance calculations, it can be shown that this temperature change has an insignificant effect on the total gas volume flow relative to the larger fluctuations occurring in the

TABLE II-1.

Comparison of Calculated and Measured Dilution Air Volumes for B-Baghouse at Facility M8

Run No.	1	2	3
Inlet Temperature, °k	301	304	307
Outlet Temperature, °k	355	378	366
Ambient Temperature, °k	273.1	277	277
Inlet Volume, scms≠	76.9	102.1	96.5
Measured Dilution Volume scms	30.7	30.7	30.7
Total Volume, scms	107.8	132.8	127.2
Calculated Dilution Volume, scms	31.5	17.4	30.9
Calculated Total Volume, scms	108.4	119.5	127.4
Ratio Total/Calculated Total	1.01	0.90	1.00

≠ scms - standard cubic meters per second

inlet gas volumes. Table II-2 compares the calculated dilution air volumes for two ambient temperatures and the measured variations in inlet gas volumes for one collector. These data show that the fluctuations in the inlet gas volume to the collector over a three-day period are greater by a factor of 30 than the corresponding variations in induced air volumes. Therefore, relative to the overall variations in total gas volume discharged by facility M, errors in the estimates of the induced air volume are minor and the corresponding errors in the mass emission rate are not significant.

4. Manufacturers' guarantees

The commenters cited as further evidence of the unachievability of the standard the refusal of manufacturers of fabric filter collectors to guarantee that their equipment will reduce emissions below 0.23 kg/MW-hr (0.51 lb/MW-hr). It is EPA's opinion that the refusal of control equipment vendors to guarantee reduction of emissions to less than 0.23 kg/MW-hr (0.51 lb/MW-hr) does not demonstrate the unachievability of the standard. The reluctance of vendors to guarantee achieving the standard is not surprising considering the variables which are beyond the control of the vendor. Specifically, the vendor does not determine the gas volume cleaned by the control device and, therefore, cannot directly control the facility's mass emission rate or the operation and maintenance of the collector. In addition, the lack of experience with performance testing of collectors makes it difficult to evaluate the performance of the collector over the guarantee period.

TABLE II-2.

Comparison of Effect of Temperature on Induced Air Volume vs Inlet Volume Variations[8]

Run No.	1	3
Inlet Temperature, °k	311	397
Ambient Temperature, °k	273.1	277
Inlet Volume, scms	76.9	96.5
Calculated Dilution Air, scms	31.5	30.8
Total Outlet Volume, scms	108.4	127.3
Δ(1-3) Dilution, Percent total	0.6	0.5
Δ(1-3) Inlet Volume, Percent total	18	18

Vendors of control equipment rarely have any control over the design of the furnace and tapping station collection systems. Since a fabric filter collector tends to control the concentration of particulate matter in the effluent, the mass emission rate is governed by the total volumetric flow rate from the control device. Compliance with the standards of performance is not accomplished solely by application of a well-designed control device. Attention must be directed also toward control of furnace gas volumes. Because of limited experience with emission testing to evaluate performance of open fabric filter collectors, the vendors do not have a good estimate of the performance of these systems over the guarantee period. For the vendor, establishment of the performance guarantee level is further complicated by the fact that performance of the collector is contingent upon its being properly operated and maintained.

Because of these factors, in the past vendors of open fabric filter collectors have been willing to guarantee performance only at levels which they are confident of achieving over the guarantee period. Generally, the guarantee levels were approximately 0.027 to 0.046 g/dscm (0.012 to 0.02 gr/dscf) for control of emissions from open electric submerged arc ferroalloy furnaces. These guarantee concentration levels are substantially higher than the concentrations (<0.003 gr/dscf) measured by EPA on well-designed and properly operated and maintained open fabric filter collectors serving open furnaces.[1]

Standards of performance are necessarily based on data from a limited number of best-controlled facilities and on engineering

judgments regarding performance of the control systems. For this reason, there is a possibility of arriving at different conclusions regarding the performance capabilities of these systems. Consequently, the question of vendors' reluctance to guarantee their equipment to achieve 0.23 kg/MW-hr (0.51 lb/MW-hr) was considered in context with the results of additional recent emission tests on fabric filter collectors. Recent emission data obtained from the ferroalloy industry show that effluent concentrations of less than 0.0090 g/dscm (0.004 gr/dscf) have been measured in properly operating compartments of open fabric filter collectors. The reported mass emission rates were all less than 0.23 kg/MW-hr (0.51 lb/MW-hr). The lowest effluent concentration guaranteed by vendors for any of the tested collectors was 0.027 g/dscm (0.012 gr/dscf). These data show that the performance of a properly operated and maintained fabric filter is significantly better than vendors are willing (or have in the past been willing) to guarantee. (The data obtained from the industry are discussed in more detail in section 5.)

On the basis of the above factors concerning vendors' guarantees of fabric filter collectors and the reported emission test results, EPA concluded that the reluctance of vendors to guarantee reduction of emissions to levels below 0.23 kg/MW-hr (0.51 lb/MW-hr) cannot be considered as evidence of the unachievability of the standard.

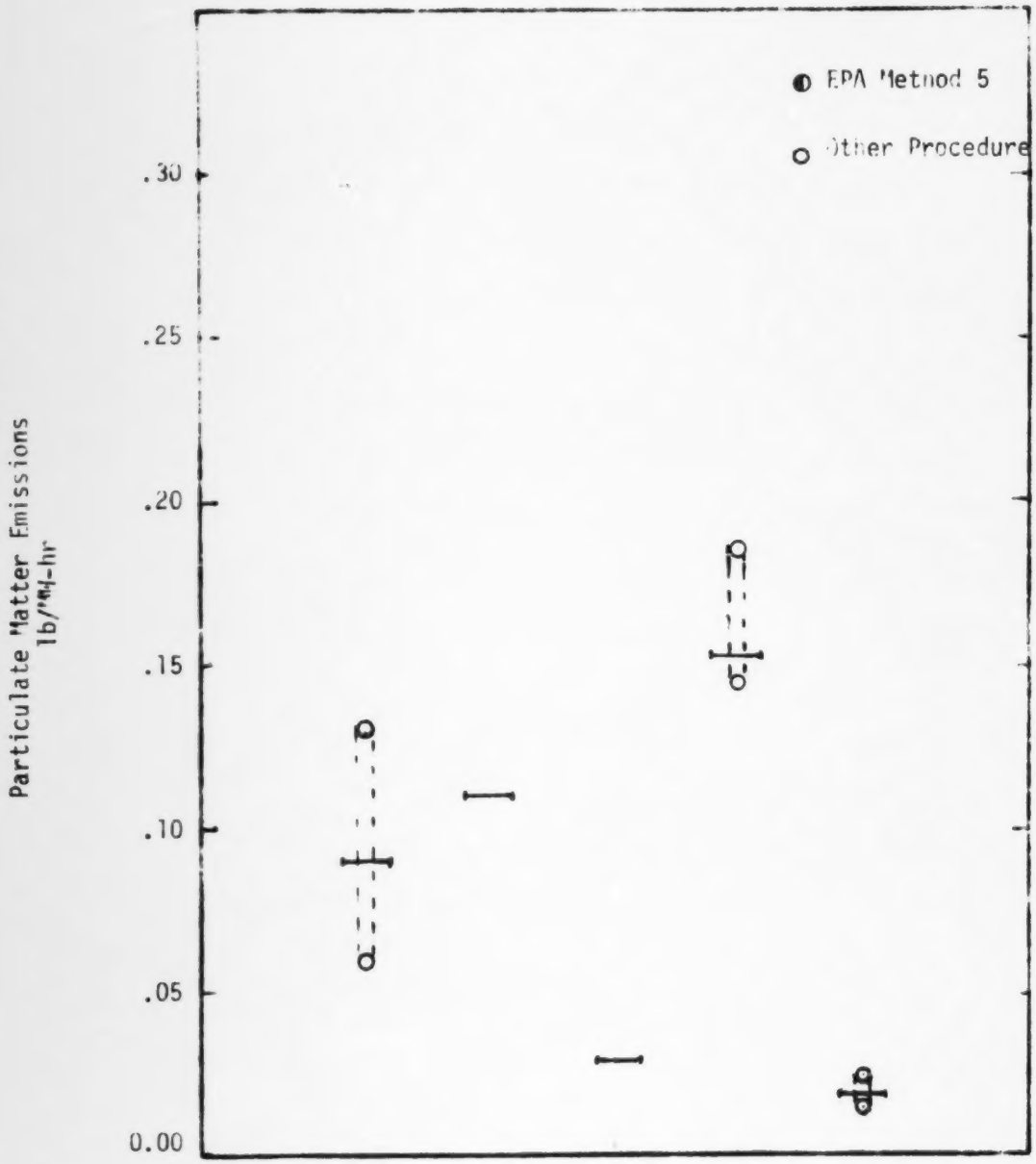
5. Additional Emission Test Results

The Clean Air Act requires that standards of performance reflect the degree of emission limitation achievable by application of the

best system of emission reduction which has been adequately demonstrated. Accordingly, the data bases for standards are necessarily limited. Because of the controversy over the achievability of the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard for ferroalloy facilities, EPA reviewed the performance of fabric filter collectors, considering the industry's experience with recently constructed furnaces.

In EPA's study of the ferroalloy industry, four facilities controlled by fabric filter collectors were emission tested, although not all collectors were properly maintained. Recognizing that the data basis for the proposed standards was limited and that a number of well-controlled facilities had started operation since completion of the original study, EPA obtained additional data to better evaluate the performance of emission control systems of interest. Under the authority of section 114 of the Clean Air Act, EPA requested copies of all emission data for well-controlled furnaces operated by 10 ferroalloy producers. Data were received for five well-controlled facilities, four of which were controlled by open fabric filter collectors; the other was scrubber-controlled. In general, these facilities had close fitting [1.52 meters (five feet) or less separation between the furnace crucible and the hood] water cooled canopy hoods; tapping fumes were collected and sent to the control device along with the furnace emissions.

The emission data submitted by the industry are reported in Appendix A and summarized in Figures II-3 and II-4. Only the emission test on the scrubber-controlled facility, facility N2, was conducted according to the procedures of Method 5. Due to the difficulties



Facility	B	AA	BB	CC	DD
Control Equipment	S		B	B	B
Furnace Size, MW	7	19	20-25	19	18
Product	FeCr	Si	Si	Si	75% FeSi

Figure II-3. Mass Emission Data Reported by Industry

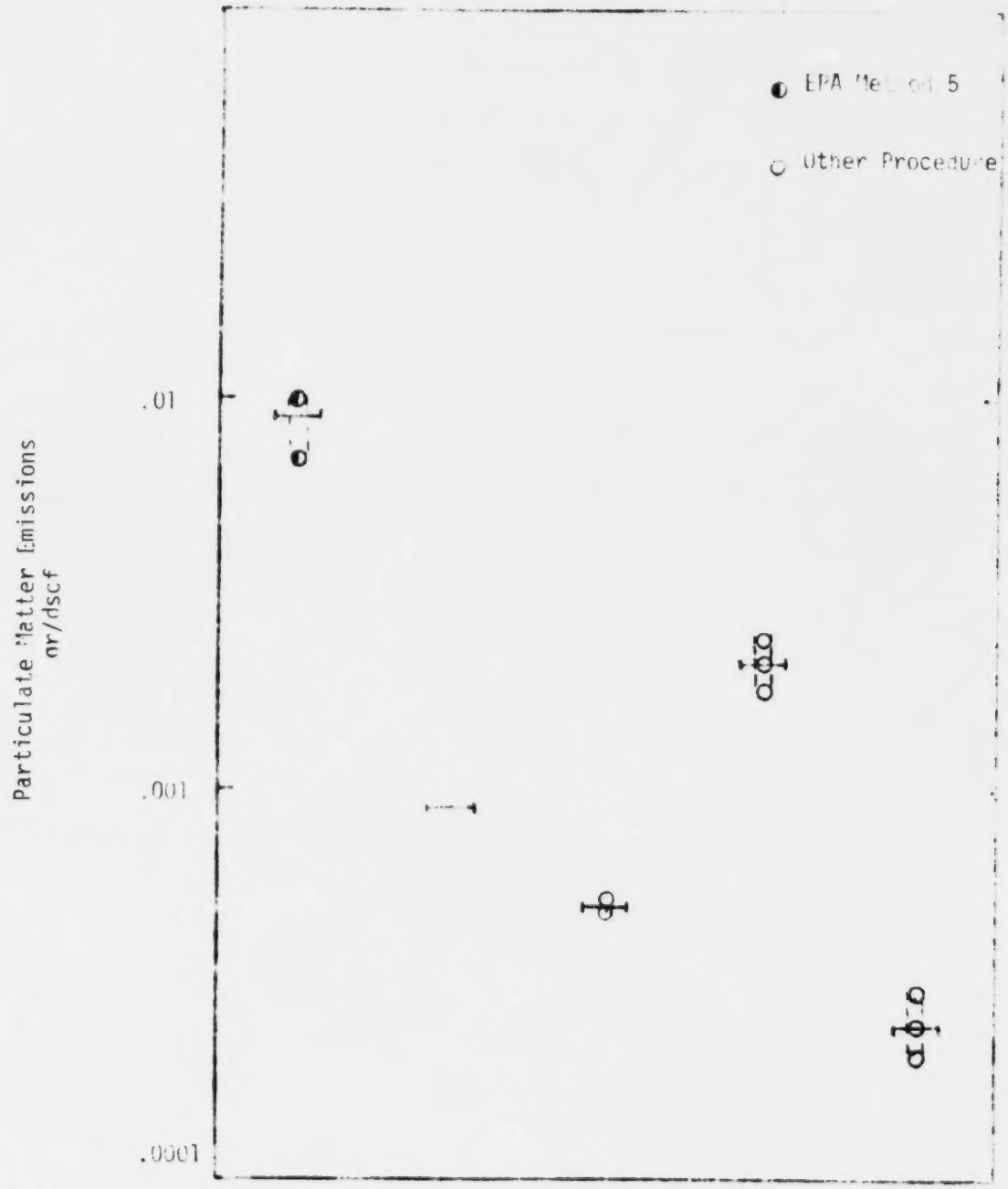


Figure II-4. Emission Concentrations Reported by Industry

associated with sample collection in low velocity gas streams and large open areas, the tests on the four open fabric filter collectors could not be conducted according to Method 5. The industry used a number of different approaches to sampling emissions from open fabric filter collectors as there are no established procedures for testing these systems. In general, the test procedure consisted of sampling at superisokinetic rates at a single point in each of a representative number of compartments in the collector. The emission sampling procedure used at facility CC differed slightly in that special equipment which allowed sampling at low velocities and isokinetic rates was used; also, the dilution air added after the fabric was restricted by blocking off the grates at the cell plate. The test results for these four facilities, consequently, are not of comparable accuracy and reproducibility; however, the data are indicative of performance levels to be expected from well-designed fabric filter collectors.

The effluent concentrations reported for these four fabric filter collectors are consistent with the levels measured by EPA on well-designed and properly operated and maintained collectors. In EPA's emission study, effluent concentrations greater than 0.0090 g/dscm (0.004 gr/dscf) were found to be associated with leaking and torn bags or improperly positioned bags in a compartment.

The data submitted by the industry show that emissions from silicon metal or 75 percent ferrosilicon production can be controlled to less than 0.0068 g/dscm (0.003 gr/dscf) and to 0.03 kg/MW-hr (0.015 lb/MW-hr). Correction of the results reported for facility CC to account for the effects of dilution air on the calculated mass

emission rate increases the rate to 0.11 kg/MW-hr (0.24 lb/MW-hr). Evaluation of other possible sources of errors and uncertainties in the data results in a maximum estimate of 0.20 kg/MW-hr (0.45 lb/MW-hr) for facility CC. All the data submitted by the industry are for furnaces which are smaller than the maximum size presently being constructed. The gas volume from an electric submerged arc furnace is governed by the furnace diameter (size) in addition to the alloy being produced and the design of the collection hood. Larger gas volumes, and hence emission rates, are expected as the furnace capacity increases. Taking into consideration the effect this scale factor would have on the emission levels, EPA concluded that emissions from large well-controlled high-silicon alloy furnaces can be controlled to less than 0.45 kg/MW-hr (0.99 lb/MW-hr) but that reduction to less than 0.23 kg/MW-hr (0.51 lb/MW-hr) is not achievable at this time.

Comparison of the supplemental data and the test data obtained by EPA shows that the difference in the emission rates for open furnaces is primarily attributable to a reduction in gas volumes from the furnaces. In 1971-1972, when EPA conducted the emission tests for the proposed standard, collection hoods were usually located about 1.8 to 2.5 meters (6 to 8 feet) above the furnace and no chain curtains or refractory lined doors, or flaps, were used to minimize the volume of induced air. The supplemental data received from the industry in January 1976 were for recently constructed furnaces and, in general, the collection systems were designed to minimize the gas volume carried by the system. Table II-3 compares the gas volumes from the older furnaces tested by EPA with the gas volumes reported by the industry for the newer furnaces. These data clearly show that substantial reductions in

Table II-3. Comparison of Furnace Gas Volumes from Open Furnaces

	Furnace SCMS	Furnace Capacity MW	SCMS/MW
A. Proposal Values			
Typical, 75% FeSi	130.4	30	4.35
Typical, Silicon Metal	217.3	25	8.69
Facility M	192.1	17	11.30
Facility O*	74.6	22	3.39
B. Industry Data			
Facility AA	90.6	20	4.54
Facility BB	67.76	21	2.99
Facility CC	62.29	15	4.15
Facility DD*	64.18	18	3.57
Facility EE	129.77	30	4.33

* Furnace producing 75% FeSi, all other facilities producing silicon metal

gas volumes can be achieved. Comparison of the data for facilities M and EE (packet-type silicon furnaces) shows that despite facility EE's greater production capacity, the measured gas volume is 33 percent lower than the measured gas volume for facility M. Similarly, comparison of the measured furnace gas volumes for facilities AA, BB, and CC (round silicon metal furnaces) with either the typical value for the industry or facility's M value shows at least a 50 percent reduction in the gas volumes from the furnace.

In EPA's opinion the supplemental data clearly demonstrate that substantial reductions in gas volumes from open furnaces are possible. These data also reinforce EPA's previous conclusion that well-designed and properly operated and maintained fabric filter collectors should reduce the concentration of emissions from open furnaces to less than 0.0090 g/dscm (0.004 gr/dscf). By use of substantially lower gas volumes and use of a well-designed and operated fabric filter collector, emissions from electric submerged arc furnaces producing high-silicon alloys will be less than 0.45 kg/MW-hr (0.99 lb/MW-hr).

In EPA's study of the ferroalloy industry, it was determined that emissions from production of high-silicon alloys would be the more difficult to control due to the finer size of the particles and significantly larger gas volumes from the furnace. Comparison of gas volumes reported for production of silicon metal and 75 percent ferrosilicon with those from chrome and manganese alloys production shows that this conclusion is still valid (see Table II-4). Therefore, the supplemental data do not indicate that reassessment of the use of the alloy group is necessary. Due to the lower gas volumes

from furnaces producing chrome and manganese alloys, it is still reasonable to expect a lower mass emission rate for such furnaces.

While data on only one chrome alloy furnace were received in response to the section 114 letters, data from several tightly hooded open furnaces were available from EPA's study of the industry. Table II-4 also provides a comparison of the furnace gas volumes with that from typical industry practice. Data for all these facilities show that substantial reductions in gas volumes relative to typical industry practice values are possible by tightly hooding the furnace. Facilities L, O, and U of the original study had gas volumes approximately 1 SCMS/MW (2000 SCFM/MW) lower than those expected based on typical hooding practices. Facilities N and N2 are small furnaces (7-9 MW nominal capacity) which are tightly hooded to allow recovery of the waste heat from the furnaces. Because of stringent control of gas volumes from the furnace, emissions from facility N2 were less than 0.045 kg/MW-hr (0.09 lb/MW-hr) despite effluent concentrations of 0.02 g/dscm (0.009 gr/dscf). In EPA's judgment the reductions in furnace off gas volumes demonstrated at facilities L, O, and U are sufficient to enable the source to readily comply with the standard.

EPA would like to emphasize that compliance with the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard does not require use of specially designed collection hoods, as at facilities N and N2. The standard is achievable by use of efficient control devices and by well demonstrated means of reducing furnace gas volumes. The water-cooled canopy hood can be designed to minimize the volume of induced air by enclosing the open area between the furnace and hood with refractory lined flaps, by use

Table II-4. Comparison of Furnace Gas Volume By Alloy Being Produced

Product (facility)	Furnace Size	Furnace SCMS	Reported Furnace SCMS	Typical[b] SCMS/MW
Silicon Metal (AA-CC)	15-20 MW	71.7	4.22	8.69
Silicon Metal (EE)	30	129.77	4.33	"
75% FeSi (DD)	18	64.18	3.57	4.35
75% FeSi[a]	40[a]	123.64	3.09	"
Si-Mn (N)	7-9	7.55	0.94	3.40
(L)	25-27	54.27	2.17	"
HC FeCr(M2)	7.3	4.25	0.58	2.45
(U)	15	27.84	1.86	"
(T)	33	73.62	2.23	"
Fe-Mn (EPA Study Values)	30	101.46		3.40
CaC_2 (EPA Study Values)	30	58.04		1.98

[a] Values reported by Commenter Z-9.

[b] Gas volumes expected for typically hooded open furnaces as designed in 1972. Gas volumes were reported for 30 MW capacity furnaces in Reference 3.

of air curtains, or by lowering the hood to 1.5 meters (five feet) above the furnace crucible. With only moderate control of the induced air volume, the gas volume from a 30 MW furnace can be held to around 6,000 dscm (212,000 dscf). If emissions from this hypothetical 30 MW furnace were controlled to a concentration of 0.0068 g/dscm (0.003 gr/dscf) by an open fabric filter collector with dilution air cooling, the mass rate of emissions would be 0.17 kg/MW-hr (0.36 lb/MW-hr). This mass rate is significantly below the standard of 0.23 kg/MW-hr (0.51 lb/MW-hr) for chrome and manganese alloys.

The control of gas volumes from open furnaces has been well demonstrated on chrome and manganese alloy production, in addition to the hotter operations of high-silicon alloy production, and effective control systems are available and well demonstrated. Therefore, the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard for chrome and manganese alloys is achievable at a reasonable cost and has been adequately demonstrated. The standard was not revised upward to 0.45 kg/MW-hr (0.99 lb/MW-hr) as suggested by the commenter as that would allow design of control systems without consideration of controlling the gas volumes.

6. Effect of quality of charge materials.

Industry representatives expressed the opinion that use of fine, friable ores which will affect furnace operation and emission rates will prevent new chrome and manganese furnaces from complying with the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard. In recent years only the finer sized chrome and manganese ores have been available at reasonable prices. Accordingly, new furnaces are expected to primarily use finer ores as feed materials. In 1971-72 during EPA's emission test program

the use of fine ores was less common and, hence, the commenters argued that the standards do not consider the effect of fine ores on emissions.

In order to more fully consider the commenters' arguments on fine ores, EPA requested that they provide data or supplemental information on experiences with operation of furnaces using fine ores to substantiate their position. At the time of the request the commenters indicated that no data on emission rates as a function of ore quality were available but agreed to provide information on operating experience. The information they submitted did not show that the use of fine ores should necessarily affect the emission rate of the furnace and the achievability of the standard. In general, the material provided by the industry representatives only discussed the general problems associated with use of fine raw materials and did not discuss any of the common solutions to these problems. EPA was aware of these general problems of fine feed materials during the development of the proposed standards.

Commonly, charge materials are sized and blended before addition to a typical furnace. The charge materials, thus, generally include a portion of fine materials. Ideally, the materials are sized and blended to produce a porous charge which will promote uniform gas distribution through the mix and furnace operating stability. Very fine feed materials affect furnace operations due to the reduced porosity of the charge which results in bridging and non-uniform descent of charge materials. The fusion and crusting over of the charge promotes channelization of the gas flow. Collapse of a bridged

area results in jets of hot gases emanating from the reaction zone. These gas blows increase the particulate matter emissions from the furnace and resulting unstable furnace operations. The problem of gas blows from the furnace can be minimized by adequate stoking of the charge to allow uniform descent and uniform evolution of the gas formed in reduction of the ores. In EPA's opinion, the blowing problem associated with use of fine chrome and manganese ores is not as significant as the problems experienced in production of silicon metal. In both cases, stoking of the furnaces at sufficiently frequent intervals to maintain a uniform evolution of reaction gases and unbridged crust will reduce uncontrolled emissions from the furnace. The effect of use of fine ores as charge material on the furnace emission rate will vary with the frequency and adequacy of stoking.

In addition to stoking the furnace, there are other methods of using finer, or more friable, ores which do not result in unstable furnace operation and increased emissions. Finer ores can be pelletized or sintered to reduce the tendency to bridge, to increase charge porosity, and to minimize entrainment losses. At present, sintering and pelletizing of fine ores is not common practice, but it could become an important pretreatment process with changing economic and supply conditions. Another possible approach is to inject the fine ores into the furnace through hollow electrodes as is done on calcium carbide furnaces.

EPA did not specifically consider the effect of size of charge materials on furnace emission rates during the emission study or development of the standard because this effect should be insignificant with a properly operated furnace. Such a furnace would be stoked at sufficiently frequent intervals to minimize gas blows and maintain stable operation. With such an operation the entrainment losses would be minimized. Fabric filter collectors are relatively insensitive to small fluctuations in inlet concentrations. Therefore, small increases in the furnace uncontrolled emission rate will not affect the achievability of the standard. The 0.45 kg/MW-hr (0.99 lb/MW-hr) standard for high-silicon alloys was not established because of a larger uncontrolled emission rate due to blowing furnace conditions. The difference between the standards for the high-silicon and the chrome and manganese alloy groups primarily results from the larger gas volumes per megawatt furnace capacity from high-silicon alloy furnaces. Consequently, EPA does not agree that the use of finer sized chrome or manganese ores will increase the emission rate of a controlled furnace or that revision of the standard is required.

C. Summary and Conclusions

In response to comments on various aspects of the data bases for the standards, EPA reassessed the rationale for the standards. From this reassessment, EPA concluded that the standards of performance for ferroalloy production facilities are achievable by application of best systems of emission reduction. Therefore, the standards of performance for chrome and manganese alloys and for high-silicon alloys are being

promulgated at the proposed levels of 0.23 kg/MW-hr (0.51 lb/MW-hr) and 0.45 kg/MW-hr (0.99 lb/MW-hr), respectively.

The reevaluation of the data bases for the standards showed that the emission test procedures used would not significantly bias the results. Review of the assumptions and the modifications made to the procedures of Method 5 to allow emission testing on fabric filter collectors showed them to be reasonable considering the nature of the effluent. Comparison of the induced air volume measured by vane anemometers with volumes expected from energy balance considerations showed that fluctuations in induced air volumes would produce only minor changes in the total gas volume flow rate from the collector. Therefore, the measured emission levels were considered representative of those achievable by best systems of emission reduction. Emission data from recently constructed well-controlled facilities show comparable levels of emission reduction to those measured by EPA and confirm the expected performance of the control systems.

The achievability of the standards was further demonstrated by data received from the industry which showed that substantial reductions in furnace gas volumes are being achieved by proper design of the collection hood. These data showed that gas volumes from well-hooded large silicon metal furnaces can be reduced to 40 percent of the volumes from typically hooded large silicon furnaces. With such good control of gas volumes and use of well-designed fabric filter collectors, emissions from these electric submerged arc furnaces were much less than 0.45 kg/MW-hr (0.99 lb/MW-hr). In addition, data were available from

EPA's earlier emission tests on several tightly hooded open furnaces producing chrome and manganese alloys. These furnaces had significantly smaller gas volumes than typically hooded open furnaces and, thus, lower mass emission rates. Emission tests conducted by EPA show that by control of gas volumes and by use of a well-designed fabric filter collector or venturi scrubber, emissions can be reduced to below 0.23 kg/MW-hr (0.51 lb/MW-hr).

The effect of raw material quality (e.g., size of ore) on furnace emission rates was considered as part of the overall evaluation of the achievability of the 0.23 kg/MW-hr (0.51 lb/MW-hr) standard. EPA concluded that with proper operating procedures, or other techniques, emissions from use of fine ores are not greater and the standard is achievable with best systems of emission reduction.

In general, EPA believes that the reassessment of the bases for the standards has shown that the standards of performance for both product groups are achievable. Information provided by the industry for well-controlled furnaces shows that the type of control system required by the standards is available at a reasonable cost and has been adequately demonstrated.

III. Opacity Standard

The proposed standards of performance limited the level of emissions from the control device to less than 20 percent opacity for both product groups. The proposed opacity standard was based on data obtained in accordance with the requirements of Reference Method 9 as promulgated on December 23, 1971 (36 FR 24876). The method required that opacity be read in increments of five percent and that compliance with the standards be determined on the basis of single readings. Thus, as proposed any single observation of opacity greater than 15 percent would be a violation of the opacity standard for an affected ferroalloy facility.

On November 12, 1974 (39 FR 39872), after proposal of the standards for ferroalloy facilities, EPA revised Reference Method 9 and the general provisions applicable to standards of performance. These revisions resulted from a study of the errors associated with single observations made by qualified observers while reading plumes according to the prescribed procedures. It was shown in this study that qualified observers can determine plume opacities with maximum positive errors of less than 7.5 percent based on the average of 24 consecutive readings. Accordingly, Reference Method 9 was revised to require that opacity observations be recorded to the nearest five percent at 15-second intervals with a minimum of 24 observations. Reference Method 9 was revised to extend the minimum time over which opacity observations are made to six minutes to obtain sufficient observations to ensure acceptable accuracy. The use of sets of opacity observations

precludes a single high reading from being cited as a violation. In addition, §60.11(e) was added to the general provisions to provide a means for an owner or operator to petition EPA to obtain a higher opacity standard for any facility that demonstrates compliance with the mass standard concurrent with failure to attain the opacity standard. The provisions of §60.11(e) allow opacity standards to be established at levels which consider the maximum expected effects of the normal range of operating variables at well-controlled new facilities.

Because of the revisions to Reference Method 9 and amendments to the general provisions, the proposed opacity standard for ferroalloy facilities was reevaluated to determine the appropriate level on the basis of six-minute average values and expected variations in operating conditions at well-controlled new facilities. It was concluded that the opacity standard should limit emissions from the control device to less than 15 percent. This opacity standard will ensure continued proper operation and maintenance of the control device and continued compliance with the mass standards. The bases for the recommended level of the standard are presented below.

The proposed opacity standard was based on 37 hours of opacity observations made in accordance with the original Reference Method 9 at seven ferroalloy production facilities. These data are presented in Volume 2 of "Background Information for Standards of Performance: Electric Submerged Arc Furnaces for Production of Ferroalloys," EPA-450/2-74-018b.[1] On the basis

of these data, the concurrent emission test results, and inspection of the observed control device, it was concluded that facilities in compliance with the applicable mass standard would have emissions of 15 percent opacity or less (based on single observation values).

Six-minute averages of the 37 hours of opacity data were calculated to convert the data to a basis consistent with revised Method 9. The six-minute average opacity values of all the observations are given in Appendix B to this report. The maximum six-minute average opacity value observed at each facility is shown in Table III-4. The maximum opacity level observed at a well-maintained and operated control device was nine percent, at facility O. Visible emissions in excess of this opacity level were observed at facility V, but the collector was not considered well-maintained due to numerous leaking bags in several compartments. The variation between the opacity levels associated with different effluent concentrations shown by the data in Table III-4 is primarily due to the variations in path length and their effect on opacity. (That is, the larger the plume diameter for a given effluent concentration, the more light will be attenuated as it passes through the plume; and hence, the greater will be the opacity of the plume.) For example, if facility O's emissions had been discharged from several stacks of 0.40 meter diameter instead of from one stack of 2.87 meters, the plume would have exhibited zero percent opacity instead of nine percent opacity. These data show that ferroalloy production facilities which achieve the mass emission standard should have emissions of less than 10 percent opacity.

Table III-4

Facility Code	Control Device	Discharge Point, Diameter, meters	Emission Concentration g/acm	kg/mw-hr	Maximum Six-Minute Average Opacity Value Observed
N	Closed pressure baghouse	2.87	0.024	0.46	9[a]
O	Open baghouse	monitor discharge	-	-	0
R	Venturi scrubber	0.387	0.022	0.005	0
S	Closed suction baghouse	0.387	0.059	0.016	0
U	Closed pressure baghouse	1.12	0.00014	0.016	0[a]
V	Open baghouse	monitor discharge	-	-	18[b]
W	Open baghouse	monitor discharge	-	-	8[b]

[a]Observer not certified.
[b]Baghouse not properly maintained.

Further, it is expected that facilities which use open fabric filter collectors will have emissions of less than five percent opacity because of the substantial dilution of the effluent which occurs in the collector.

In addition to the Method 9 observations of emissions, an evaluation was made of the effects of variations in operating parameters on plume opacity. To ensure that the opacity standard is established at a level which is not more restrictive than the mass standard, Bouguer's Law was used to analyze the effects on plume opacity of variations in effluent concentrations, particle characteristics, and stack diameters. The values used for the operating variables in the analysis consisted of measured values and values that could potentially produce the maximum opacity within the limitations of the mass emission standards and possible effluent gas volumes.

The range of possible effluent concentrations and stack diameters at well-controlled ferroalloy production facilities is a function of the design of the emission collection system and the alloy being produced. As typically designed in the U.S., open electric submerged arc furnaces have a water cooled canopy hood located about 1.5 to 2.5 meters (five to eight feet) above the furnace rim. This large vertical opening between the furnace and hood permits large quantities of air to be drawn into the emission collection system. The volume of induced air can be significantly reduced by design of the collection hood to minimize the open area between the furnace and the hood.

For typically hooded open furnaces producing the various alloys, effluent concentrations less than 0.023 g/dscm (0.016 g/acm) [0.01 g/dscf or 0.007 gr/acf] are required for compliance with either of the mass standards. Effluent concentrations for tightly hooded open furnaces could possibly be 0.034 to 0.046 g/dscm (0.015 to 0.02 gr/acf) if substantial dilution of emissions does not occur in the control device. Although these concentrations are theoretically allowed by the mass standards, the concentrations are unlikely if emissions are controlled by a well-designed fabric filter collector or venturi scrubber. To ensure consideration of all expected variations in operating parameters for both typically and tightly-hooded furnaces, concentrations of 0.011 to 0.046 g/acm were considered in the opacity calculations.

The opacity of a plume is affected by the path length through which the light is attenuated. The dimensions of discharge points or areas on control devices used at ferroalloy facilities varies with the type control device and the gas volume being treated. Ferroalloy production facilities in the U.S. generally use open fabric filter collectors to control emissions from the electric submerged arc furnaces. Generally, the gases from these collectors are discharged to the atmosphere through a monitor or through stub stacks. The shortest dimension of the monitor or stack is the path length through which emissions are observed when using Method 9. For typical roof monitor discharges, these path lengths are

expected to vary from 2.0 to 4.3 meters. Some modular construction collectors may have monitors of smaller dimensions than these. Closed pressure or closed suction collectors or venturi scrubbers are less commonly used by the ferroalloy industry, but they might be installed in a few cases since they are easier to emission test. Stack diameters for these control devices are related to the size of the facility and the gas volume being treated. In EPA's study of the industry, the largest observed stack diameter was 3.0 meters.

Should a facility use a larger than expected stack diameter, thus causing the opacity of the facility's emissions to exceed the level of the standard, the owner or operator may request that the EPA establish a special opacity standard for that facility under the provisions of section 60.11(e).

In addition to concentration and path length observed, the light scattering and absorbing characteristics of the particulate matter are important factors in the mass-opacity relationship. Particulate matter emissions from ferroalloy electric submerged arc furnaces consist mainly of condensed metal oxide fumes and entrained furnace charge materials. Thus, all particles emitted from the control device are expected to be less than 1.0 micrometer actual diameter, to vary over a limited size range for each alloy, and to be spherical. Particle size analysis of emissions from production of high-silicon alloys showed that the mass mean diameter of the particulate from the control device varied from 0.1 to 0.4 micrometer diameter for the various alloys.[3] These emissions

were found to be primarily transparent, spherical, silicon dioxide particles.[3] Analysis of emissions from chrome and manganese alloy production showed that the mass mean diameters of the particulate varied from 0.2 to 0.6 micrometer diameter for various alloys, and the emissions consisted of opaque, spherical, metallic oxide (black, brown) particles.[3]

The light attenuated by a plume was calculated using Bouguer's Law as expressed by Ensor and Pilat[9] for a polydisperse aerosol (the distribution of particle sizes about the mean is considered). So, variations in particle size of emissions are inherently considered in the calculation procedure. Plume opacities were calculated for both tightly-hooded and typically-hooded open furnaces producing either high-silicon alloys (white aerosol m = 1.5) or chrome and manganese (black aerosol) alloys. For all probable cases, the calculated plume opacities are less than 15 percent.[8] For well-controlled, typically-hooded open furnaces, the maximum opacity calculated is less than 10 percent for "high-silicon" alloys and less than 13 percent for chrome and manganese alloys. For well-controlled, tightly hooded open furnaces (concentration $\leq$0.023 g/dscm), the maximum opacity calculated is less than 10 percent for both product groups. Tightly hooded open furnaces controlled only to the level of the applicable mass standard are expected to have plume opacities less than 12 percent for high-silicon alloys and less than 14 percent for chrome and manganese alloys.

On the basis of the projected opacity levels, EPA has concluded that typical variations in effluent concentration, stack diameter, and particulate matter characteristics do not justify establishing the opacity standard at a level greater than 15 percent opacity. The Method 9 opacity observations further indicate that establishing the opacity standard at a level greater than 15 percent could allow less effective control of emissions than is required by the mass emission standards. The 15 percent opacity standard is achievable by well-controlled, typically or tightly hooded open furnaces whose emissions are in compliance with the applicable mass standard.

Few, if any, facilities are expected to require establishment of special opacity standards under the provisions of §60.11(e). An example of an atypical facility which would require a special opacity standard would be any facility which, although in compliance with the mass standard, has a higher than expected effluent concentration and discharges emissions to the atmosphere through a larger than expected stack or monitor. The provisions of §60.11(e) allow the owner or operator of such an atypical facility to petition the EPA Administrator for establishment of a special opacity standard. Thus, no owner or operator of an atypical facility will be prejudiced by this establishment of the opacity standard on the basis of typical variations in operating corditions.

IV. Alternative Test Procedures for Open Fabric Filter Collectors

The provisions of §60.266(d) of the promulgated regulation require the owner or operator to design and construct the control device to allow measurement of emissions and flow rates using applicable test methods and procedures. This section does not permit the use of control devices (such as open pressurized fabric filter collectors) from which emissions cannot be measured by reference methods in Appendix A of 40 CFR Part 60, unless compliance with the promulgated standard can be demonstrated by an alternative method. EPA has not specified an emission test procedure for open pressurized fabric filter collectors because of the large variations in the design of these collectors. Test procedures can be developed on a case-by-case basis, however. Provisions in 40 CFR 60.8(b) allow the owner or operator upon approval by the Administrator to use an "alternative" or "equivalent" test procedure to show compliance with the standards. EPA emphasizes that development of the "alternative" or "equivalent" test procedure is the responsibility of any owner or operator who elects to use a control device not amenable to testing by Reference Method 5. From general comments on the standards, it was apparent that considerable misunderstanding existed concerning acceptable alternative procedures for demonstration of compliance. The following discussion is provided to give general guidance in the major areas of concern.

Pressurized fabric filter collectors are not amenable to representative sampling by Reference Method 5 because of, among other things, the

large areas through which emissions are discharged to the atmosphere and the low velocities of the effluent. The large areas make it difficult to determine sampling points which adequately represent the entire area. The velocities of gases discharged from these large areas are very low, typically around 2 meters per second (400 fpm). Velocities in this range cannot be measured by conventional sampling equipment. Consequently, isokinetic sampling and accurate determination of volumetric flow rates using conventional equipment are not feasible.

Possible approaches to emission sampling in large areas and low velocity gas streams require consideration and evaluation of the condition of the collector and the capabilities of the sampling equipment. In general, if all compartments in a collector are in equivalent condition and operating under comparable conditions, then sampling of emissions from a randomly selected, representative number of compartments is an acceptable alternative procedure. Another possible alternative procedure is to subdivide the roof monitor area into subareas which are then sampled. If all compartments are not equivalent in condition or operation, then it is necessary to either repair the collector, sample emissions from all compartments, or bias the sample by emission testing the compartments in poorer condition.

One alternative for sample collection when isokinetic sampling of the effluent is infeasible is sampling at a predetermined average velocity rate. This alternative, which minimizes many of the problems of sampling in these systems, consists of determining

the average velocity in the area, using devices for low-velocity measurements, and emission sampling at this rate for the entire sampling period. If the sampling equipment is not amenable to this procedure, then nonisokinetic sampling of the effluent may be considered because of the small particle size of the emissions. Subisokinetic sampling of emissions is the recommended procedure as it assures collection of any large particles escaping from bags which are improperly positioned or leaking. (Subisokinetic sampling, sampling at lower velocities than the gas stream velocity, biases the sample toward collection of a greater amount of particulate matter per unit volume, and hence a greater concentration than is actually present.) In situations where subisokinetic sampling is not possible, superisokinetic sampling using a large diameter nozzle and a large sample volume may be permissible subject to approval by EPA. Approval of superisokinetic sampling is, among other things, subject to verification that all compartments are in good operating condition and to demonstration by measurement or reasonable engineering judgment that particles larger than five micrometers aerodynamic diameter are not present in the gas stream.

Because of the induction of cooling air into open pressurized fabric filter collectors and the problems associated with velocity measurements, alternative procedures are required for determination of the total gas volume emitted from the control device. When the average velocities in the subareas are determined during the emission test, the volumetric flow rate can be calculated from the known discharge area. The volumetric flow rate can also be

established by the measured inlet flow rate and the measured induced air volumetric flow rate. An example of an alternative test method acceptable for demonstration of compliance is one in which emissions are sampled at a predetermined average velocity rate in representative subareas of the collector, and the volumetric flow rate is calculated from the average velocity and discharge area. In terms of general concepts, the test procedure used at facility CC employed this overall approach. That is, emissions were sampled at the predetermined velocity in the center of each compartment above the grate over the rocker arm and were sampled using a large diameter nozzle and large volumes. With the exception of minor details of the procedure, the general approach used at facility CC would be an acceptable alternative method for demonstration of compliance.

These possible alternative approaches to emission testing of pressurized fabric filter collectors are intended for general guidance only. It is emphasized that an "alternative" procedure for demonstration of compliance is dependent upon specific design features of the collector, the conditior of the collector, and the sampling equipment available. Due to the costs of testing, the owner or operator should obtain EPA approval for a specific test procedure or other means for determining compliance before construction of a new source. Under the provisions of §60.6, the owner or operator of a new facility may request review of the acceptability of proposed plans for construction and testing of control systems which are not amenable to sampling by Reference Method 5. If an acceptable "alternative" test procedure is not developed by the owner or operator, then total enclosure of the pressurized fabric filter collector and testing by Method 5 is required.

V. Economic and Inflationary Impact

As explained in Chapter II of this report, the mass emission standards for both product groups were reevaluated in view of comments received on the achievability of the standards and the representativeness of the data bases. Data received in January 1976 from the industry indicated that gas volumes from open furnaces producing silicon metal (and other high-silicon alloys) were substantially lower than those typically observed during EPA's 1972 study of the industry. Consequently, the control costs estimates for a large silicon metal furnace were revised to reflect this information. Because no data indicating substantial reductions in gas volumes from chrome and manganese alloy furnaces were received, the control costs for these furnaces were not reassessed. However, all the control cost estimates were updated to 1975 dollars from the previous basis of 1972 dollars.

The control cost estimates for a large silicon metal furnace were adjusted to reflect a gas flow of 214 actual cubic meters per second, acms, at 478°K (454,000 acfm at 400°F) from a 30 MW capacity furnace. The previous control cost estimate was based on a gas flow of 354 acms at 478°K (750,000 acfm at 400°F) from a 25 MW capacity furnace. The costs reported in Volume 1 of "Background Information for Standards of Performance: Electric Submerged Arc Furnaces for Production of Ferroalloys" were adjusted using a scale factor to account for gas volume differences and inflation indices. The investment costs for a fabric filter collector for the 30 MW furnace are estimated to be $2,644,000 in 1975 dollars. Annual operating costs were similarly

adjusted and are $909,000 in 1975 dollars. The annual operating costs per ton of alloy produced reflect the slightly greater productivity of the larger furnace. The costs are summarized in Table V-1.

The estimates of control costs for furnaces producing 50% FeSi, HC FeMn, SiMn, HC FeCr, and CaC_2 were updated to 1975 dollars from the original basis of 1972 dollars using inflation indices. These costs are 45-50 percent higher than the 1972 estimates due to a 31 percent increase in general construction costs and substantial increases in the cost of electrical power.

At the time of the original economic analysis, domestic ferroalloy prices were frozen at levels one-half to one-third the selling prices of imported ferroalloys. Since 1972, price controls on ferroalloys have been removed, and quoted prices have increased 190 percent for 50 percent ferrosilicon to 250 percent for silicon metal. The updated and revised annual operating cost estimates now represent a smaller proportion of the product selling price. Consequently, the conclusion of the original economic analysis that the control costs are reasonable and can be passed on to consumers is not affected by the updating of the control costs.

The economic impact of the standards of performance is minimal when the costs of achieving a typical State process weight regulation are considered. The same control system must be installed to meet typical State regulations or the standards of performance, although the standards of performance may require slightly more efficient capture of tapping fumes than some State regulations. Based on the possible

increase in costs due to tapping fume control, the five year costs and the fifth year annualized costs of implementation of the standards were estimated as $2.5 million and $0.84 million, respectively. Therefore, the inflationary impact of the standards of performance on the price of ferroalloys is insignificant. Further, the conclusion of the economic analysis remains that the costs are reasonable and should not bar entry to the market or expansion of facilities for small businesses.

Table V-I - SUMMARY OF CONTROL COST FOR STANDARDS OF PERFORMANCE FOR FERROALLOY PRODUCTION FACILITIES[a]

AFFECTED FACILITY	STANDARD OF PERFORMANCE	BASIS FOR COST ANALYSIS: TYPICAL SIZE	BASIS FOR COST ANALYSIS: CONTROL EQUIPMENT	ESTIMATED COST: INVESTMENT COST, $	ESTIMATED COST: ANNUAL COST, $/YR	ESTIMATED COST: ANNUALIZED COST, $/TON	PRODUCT PRICE, $/TON
Electric Submerged Arc Furnaces	0.45 kg/MW-hr (Si, FeSi, CaSi, SMZ)	30 MW 50% FeSi	Fabric filter.[b]	3,013,000	961,000	20.23	330
		30 MW Si	Fabric filter.[b]	2,644,000[d]	909,000[d]	53.73	850
	0.23 kg/MW-hr (HC FeCr, charge chrome. FeMn, SiMn, CaC_2, FeCrSi, FeMnSi, Silvery Iron)	30 MW HC FeMn	Fabric Filter.[b]	2,489,000	803,000	8.12	440
		30 MW SiMn	Fabric filter.[b]	2,489,000	803,000	18.26	480
	For both groups: < 15% opacity from control device No visible emissions escaping the tapping station during 60% of the time when tapping is taking place. < 10% opacity from dust handling equipment.	30 MW HC FeCr	Fabric filter.[b]	1,965,000	646,000	12.76	700
		30 MW CaC_2	Fabric filter.[b]	1,703,000	564,000	6.26	171
		33 MW HC FeMn (sealed)	Scrubber.	4,585,000[c]	1,139,000	11.51	440
		38 MW SiMn (sealed)	Scrubber.	4,585,000[c]	1,139,000	25.89	480
		30 MW CaC_2 (sealed)	Scrubber.	2,201,000[c]	626,000	6.88	171

[a] costs except for the sealed furnace. Actual economic impact will be minimal when State standards are considered since State and eral standards require the same types of control equipment.

[b] Scrubbers could also be used. Capital costs are about the same except for 50% FeSi which is 50% higher. Annual costs are greater by about 50%.

[c] Includes adjustment for increased cost of sealed furnace.

[d] Costs based on gas flow of 214 acm at 480°K (454,000 acfm at 400°F) through fabric filter.

VI. Summary of Public Comments and EPA Responses

Eighteen comment letters were received on the proposed standards, nine of which came from the ferroalloy industry, five from State and local air pollution control agencies, and four from Federal agencies. The comments were carefully considered, and where determined by the Administrator to be appropriate, changes were made to the proposed regulation.

Table VI-1 lists the name and affiliation of each person who commented and Table VI-2 presents a key to the code for affiliation category. The summary of the comments and EPA's responses follows Table VI-2.

Ferroalloy Production Facilities Comment Summary

Table VI-1. List of Commentators

Comment No.	Commentator	Affiliation	Code
Z-1	J. W. Gallion	Oklahoma State Department of Health	A
Z-2	J. W. Cooper	Alabama Air Pollution Control Commission	A
Z-3	J. L. Biggane	State of New York, Department of Environmental Conservation	A
Z-4	W. Simmons	State of California, Air Resources Board	A
Z-5	R. T. Bailey	Foote Mineral Company	D
Z-6	C. R. Allenbach	Union Carbide Corporation	D
Z-7	G. A. Watson	The Ferroalloys Association	E
Z-8	W. R. Meyer	Commonwealth of Virginia, State Air Pollution Control Board	A
Z-9	L. C. Wintersteen	Airco Alloys	D
Z-10	S. D. Doremus	U. S. Department of the Interior	C
Z-11	A. L. Bayles	Allison L. Bayles & Associates	F
Z-12	E. R. Zausner	Federal Energy Administration	C
Z-13	W. C. Roundtree	General Counsel of the Department of Commerce	C
Z-14	R. L. Duprey	EPA - Division of Stationary Source Enforcement	B
Z-15	O. D. Jordan	Ohio Ferro-Alloys Corp.	D
Z-16	R. D. Turner	Chromium Mining and Smelting Corp.	D
Z-17	E. L. Lantz	International Minerals and Chemical Corporation	D
Z-18	J. Maloney	Satralloy Inc.	D

Table VI-2. Code to Affiliation Category

Code	Affiliation Category
A	State or Local Air Pollution Control Agency
B	U. S. Environmental Protection Agency
C	Other Federal Government Agencies
D	Ferroalloy Industry
E	Professional Ferroalloy Industry Association
F	Consulting Firms

Summary of Comments and Responses to the Proposed Standards of Performance for Ferroalloy Production Facilities (39 FR 37470)

Preamble

1. The proposed standards appear to be reasonable and enforceable. Z-3(A), Z-12(C)

   Response: No response necessary.

2. Review of the proposed regulations was hampered by the unavailability of the Background Document. Z-10(C), Z-13(C)

   Response: EPA recognizes that the unavailability of the documents made meaningful review difficult. Consequently the end of the comment period was extended from December 5, 1974 to December 30, 1974.

3. Agree with the decision not to require use of sealed furnaces at this time. Z-10(C)

   Response: No response necessary.

4. The preamble alleges that sealed furnaces are inherently superior from an air pollution control aspect. This statement, however, has not been adequately demonstrated and ignores other sources of emissions due to sealed furnaces. For example, most sealed furnaces require special raw material preparation which may also contribute to air pollution. This misimpression should be corrected. Z-11(F)

   Response: EPA does not agree with the commentator that the preamble inaccurately discussed the air pollution aspects of sealed furnaces. Sealed furnaces used in conjunction with venturi scrubbers or fabric filters are inherently superior to an open furnace from both an air pollution control aspect and an energy conservation aspect even when they use similar control equipment. Comparison of equivalent open and sealed furnaces reveals that due to the lower air volumes which require treatment, the controlled emissions from a sealed furnace are between 0.5 to 2 percent of the mass of particulate emitted by comparable open furnaces. Furthermore, the air pollution control device for a sealed furnace requires less than 10 percent of the power required for the control devices on open furnaces.

The alleged additional pollution due to raw material preparation would not necessarily occur. Observations of sealed furnaces in Norway by EPA engineers showed that sealed furnaces do not inherently require raw material preparation. For production of certain grade ferroalloys, raw material preparation was practiced. Emissions from sintering and pelletizing can be controlled by a venturi scrubber or fabric filter collector. If the controlled emissions from sintering and pelletizing are considered in the mass emission rate of the sealed furnace, it is still superior to an open furnace from air pollution control aspect.

The decision to allow open furnaces was based on economic considerations of reduced product flexibility and possible decreased intercorporate competition. It was the Administrator's judgment that these factors would make the costs of the additional emission reduction unreasonable. Accordingly the standards were established at levels such that open furnaces could be used.

5. Agree with the Department of Commerce's position on opacity standards. Z-10(C)

Response: EPA's position is unchanged from its consideration of this issue in the "EPA Response to Remand Ordered by U. S. Court of Appeals for the District of Columbia in Portland Cement Assoc. vs. Ruckelshaus (486 F. 2d 375, June 29, 1973)." See also the response to comment 3 of section 60.262.

6. The cost of compliance for modified facilities should be considered in determining the reasonableness of the control costs. Z-13(C)

Response: A source is considered "modified" under the Clean Air Act only if the change results in increased emissions. If the electric submerged arc furnace's or the entire shop's emissions are controlled to the pre-modification level, the esa furnace would not be considered modified and hence would not be subject to the standards of performance. Therefore, few existing furnaces would be subject to the standards of performance. The costs for upgrading the emission control system of any furnace that is "modified" were not developed because a realistic general assessment of the changes required is not feasible. The cost of controlling a "modified" esa furnace emissions will vary with each facility's control system and the physical space available. The ease of design and costs of hoods and other equipment for efficient capture of pollutants will vary significantly depending on the building housing the furnace. The amount of upgrading of the control device required will depend on the quality of the original system.

7. The proposed regulations require design of the control system to meet the most stringent expected level of control. A variance should be issued to permit short term production of alloys which exceed the applicable standard because the control system was not designed for control of that alloy's emissions. Z-13(C)

Response: It is entirely consistent with the requirements of the Act to establish standards at levels which require design of the control system for the most stringent level of control expected. According to the industry it is only feasible to produce members of the same product family in the same furnace. Since members of the same product family have comparable uncontrolled emission rates and the same mass standard, the degree of control required will be comparable for all members of the product family.

8. A significant amount of disposal of collected material by landfill probably will not occur because of the possibility of use of recycle techniques developed by the steel industry. Z-10(C)

Response: No response necessary.

9. The preamble incorrectly stated that the ferroalloy industry disposes of collected dust by landfill. The preamble discussion should be corrected (amended) because the industry has actively sought productive uses for these wastes for a number of years. Z-7(E)

Response: Waste disposal practices of the ferroalloy industry were reassessed as a result of discussions with this commentator. Available information still indicates that in the U. S., the ferroalloy industry primarily disposes of solid wastes by landfill rather than by recycle of these wastes. However, productive uses for these wastes are being sought by the industry as evidenced by research in this area. The preamble discussion was intended primarily to describe prevailing practices, not future waste disposal practices, and to provide guidance for proper disposal.

10. EPA has failed to discuss the reasons for the standards for ferroalloy being markedly different than the standards for electric arc furnaces in the steel industry since the two processes are so similar. Z-13(C)

Response: EPA disagrees that the two processes are so similar that either similar standards of performance are required or that a justification for the difference between the standards is required. The two standards differ because of major differences in the location of collection hoods over the furnaces, the control systems employed, and shop conditions.

The maximum separation between the collection hood and any electric submerged arc furnace used in the production of ferroalloys would be 6-8 feet on an open furnace. Tightly hooded ferroalloy furnaces do not have a significant separation between the furnace and the hood. Steel electric arc furnaces can use a building evacuation, combination direct shell evacuation-canopy hood, or combination side draft hood-canopy hood control system to capture emissions and control them to the level of the standards. With all these control systems capture of at least part of the emissions must be done by a canopy hood located 30 to 40 feet above the furnace. This separation between the furnace and the hood is necessary to allow free movement of the crane which charges raw materials to the furnace. The difference in the separation between the two type furnaces and their respective collection systems affects the ability of the hoods to effectively capture emissions. The standards requiring effective capture of furnace emissions, consequently, differ because of differences in the location of the canopy hood for the two processes. In electric arc furnace shops, the fumes from charging, tapping, and other shop activities rise and accumulate in the upper areas of the building, thus obscuring visibility. Because of the poor visibility within the shop, the performance of the emission capture system can only be evaluated at the point where emissions are discharged to the atmosphere. Ferroalloy electric submerged arc furnaces do not require a large free space between the canopy hood and the furnace. Visibility around the electic submerged arc furnace is good. Consequently, the performance of the collection device on a ferroalloy furnace may be evaluated at the collection area rather than at the point of discharge to the atmosphere.

For ferroalloy furnaces a mass standard is preferable to a concentration standard of performance because the latter would have allowed use of larger than necessary exhaust volumes and would have precluded use of sealed furnaces. Sealed ferroalloy furnaces can have exhaust gas volumes as low as 2 to 5 percent of that from an open furnace of equivalent size. Mass emissions from a controlled sealed furnace are much less than from a controlled open furnace, even though the emissions from a controlled sealed furnace are more concentrated. A concentration standard based on use of sealed furnaces would allow more control on open furnaces. Also a concentration standard for ferroalloy furnaces could permit the designer of the control system to neglect consideration of the volume of gases exhausted.

A mass standard of performance was considered for electric arc furnaces in the steel industry, but was not selected due to other considerations. These other factors include: (1) effective capture of tapping and charging fumes requires exhausting large gas volumes through the canopy hoods to maintain adequate capture velocities and (2) restricting the gas volumes could in some hot climate areas and with building evacuation control systems result in a conflict with OSHA requirements. These factors made a concentration standard the only practical method of regulating the electric arc furnace emissions on a consistent basis nationwide.

11. Particle size, shape, density, color etc. will vary from day to day as well as with the product. Consequently a functional mass-opacity relationship cannot be developed. Z-17(D)

Response: The joint EPA - The Ferroalloy Association study analyzed particulate matter samples of various ferroalloys for aerodynamic particle size, particle density, elemental composition, crystalline structure, and color. The conclusion drawn from these data was that the range of variation was not so great as to preclude establishment of an opacity standard which is indicative of proper operation and maintenance of the control device.

Section 60.261

1. The definition of "control system" in paragraph (l) should be restricted to the gas cleaning device. Z-5(D)

Response: EPA disagrees with the comment. The ancillary equipment such as the hoods, ducts, fans, dampers, etc., which capture or transport the emissions is part of the overall control system (and its costs). However, confusion over the intent of the provisions showed that separation of the definition into the terms "control device" and "capture system" was advisable. The final regulation limits emissions from the control device and limits emissions escaping capture by the capture system.

Section 60.262

1. The wording of paragraph (a) implies that the mass emissions standards are applicable to the "dust handling equipment" as well as the control device. The word "facility" should be changed to "furnace" and this section should be rewritten. Z-14(D)

Response: This section has been revised as suggested.

2. The standard for ferrochrome silicon should be 0.45 kg/MW-hr instead of 0.23 kg/MW-hr because of the considerable energy savings (280 vs. 1800 KW) that can be realized. Z-6(D), Z-7(E), Z-9(D), Z-18(D)

Response: The standard for FeCrSi is based on emission data from sealed as well as open furnaces. Both furnaces tested met the proposed standard of 0.23 kg/MW-hr (0.51 lb/MW-hr). The standard of performance for furnaces producing ferrochrome silicon reflects the degree of emission reduction achievable by application of the tested systems(fabric filter collectors on open furnaces or venturi scrubbers on sealed furnaces). The standard of performance was not intended to allow use of less efficient control systems. The argument that increasing the standard to 0.45 kg/MW-hr (0.99 lb/MW-hr) would result in a substantial energy savings assumes that electrostatic precipitators rather than baghouses would actually be installed. From previous discussions with members of the ferroalloy indstury, EPA concluded that due to operational problems use of precipitators is unlikely regardless of the level of the standard. The actual result of relaxation of the standard would be installation of less efficient control systems and/or neglect of the air volumes being treated. If reduction in energy consumption is of prime concern, then use of closer fitting hoods or sealed furnaces should be considered.

3. The control device's opacity standard should be based on a functional mass-opacity relationship. Without such a relationship the standard should only be used as a "triggering mechanism" to indicate a possible violation of the concentration standard. Z-13(C)

Response: EPA believes that a complete functional mass-opacity relationship need not be established in order to develop opacity standards which require proper operation and maintenance of the control system. In cases where both mass or concentration and opacity standards are established, it is EPA's policy to not require application of a more efficient control system than necessary to achieve compliance with the mass or concentration standard. These opacity standards are established at levels based on consideration of conditions that would produce maximum obscuration of light at typical well-controlled facilities. Opacity levels associated with improper and maintenance of the control device are also considered in the determination of the level of the standard. Thus, as structured by EPA, the opacity standards will be exceeded only by facilities which fail to properly operate and maintain the control equipment.

Use of opacity limits only to create a "rebuttable presumption of a violation" would allow an owner or operator to routinely inadequately operate or maintain the pollution control equipment except during periods of emission testing. It takes two weeks or longer to schedule a typical Method 5 performance test. If only small repairs were required, e.g. fabric filter bag replacement, remedial action could be delayed until shortly before the emission test is conducted. For control systems using scrubbers, the energy input could be reduced (the pressure drop through the system) when stack tests were not being conducted, which would result in the release of significantly more particulate matter than if the system were being properly operated. For these reasons, owner or operators are required to properly maintain air pollution control equipment at all times [40 CFR 60.7(d)] and to meet opacity standards at all times except during periods of startup, shutdown, and malfunction [40 CFR 60.11(c)] and during other periods of exemption specified in the applicable standards.

In development of the opacity standard, EPA determined that opacity and particulate matter emission rates were quantitatively related at ferroalloy production facilities. Data collected during the standards development process showed that a typical well-controlled open furnace with an emission rate of 0.45 kg/MW-hr (0.99 lb/MW-hr) will have a plume opacity below 15 percent (based on six-minute average value). Specifically, the opacity standard is based on observation of emissions at seven ferroalloy facilities as well as consideration of the maximum effect of the normal range of particle characteristics and stack diameters on plume opacity. At four of the seven facilities, the opacity observations were conducted concurrently with the particulate matter emission testing. The maximum six-minute average opacity value observed was nine percent (read across a 10 foot diameter stack) and was associated with a mass emission rate of 0.45 kg/MW-hr (0.99 lb/MW-hr). Facilities with lower emission rates or smaller stack diameters had no visible emissions. The observed apparent plume opacities are consistent with plume opacities predicted by Bouguer's Law for the same stack diameters and effluent concentrations. Thus, the opacity of emissions from ferroalloy facilities is sufficiently related to the mass emissions to be a reliable measure of emissions. These data, and projections of plume opacities, clearly indicate that a well-operated and maintained control system on an open furnace that meets the applicable mass emission standard will have visible emissions substantially below the opacity standard of 15 percent. Opacity levels in excess of the standards are indicative of improper operation and maintenance of the control system and emissions in excess of the applicable mass standard.

4. The same opacity standard is proposed for both categories of mass emission rate standards. Separate opacity standards for each mass emission rate standard would be more appropriate. Z-13(C)

Response: A single opacity standard for both mass emission rate standards was recommended to simplify the regulation and its enforcement. Separate opacity standards were not established because the mass standards differ more due to differences in effluent gas volumes for the product categories than due to differences in effluent concentration. Since opacity is concentration dependent (among other variables), these variations in gas volumes resulted in an overlap of expected opacity values for the two groups of products. A single opacity standard, therefore, was established on the basis of maximum expected effluent concentration and maximum expected stack diameter. This standard requires proper operation and maintenance of the control device and is achievable by facilities subject to either of the mass standards.

5. Fugitive emissions from the furnace cover are a minor fraction of total emissions and are an insignificant contribution to degradation of ambient air quality. Paragraph (3)(i) is thus unnecessary. Z-5(D), Z-11(F)

Response: Emissions from the electric submerged-arc furnace hood or cover and the tapping station hood can, if not properly captured, be a significant fraction of the total emissions due to the furnace. (In some cases the amount of particulate matter escaping the collection hoods is greater than the emission rate from the control device.) The intent of standards of performance is to require application of best demonstrated control technology. Adequate capture of emissions at the point of generation is an integral feature of the control level sought by the standards.

6. The fugitive emission standard for the furnace collection hood is not technically feasible and the standard is based on insufficient data. Therefore paragraph (3)(i) should be deleted. Z-9(D)

Response: The fugitive emission capture requirement for the furnace is technically feasible based on observations at well-controlled facilities. The standard is based on observations at facilities observed in the survey for well-controlled facilities and long term observation at four facilities. The canopy hoods over four open furnaces were observed one hour each for a total of four hours. No visible emissions were observed to escape any of these furnace hoods. The covers of several sealed furnaces were observed also for visible emissions during the emission test program. No visible emissions were observed to escape the cover of a sealed furnace with properly maintained seals. Deletion of this requirement without adding a standard limiting emissions exiting from the shop would allow inadequate capture of the furnace fumes. Opacity standards on shop emissions are impractical and unnecessary for this source. See comment 13 for further discussion on this point.

7. Paragraph (3)(i) requirement is not practical on a 100% of the time basis. Violent reactions which are a function of the alloy chemistry can cause puffing from the hood openings. The 100 control requirement will result in increased consumption of electricity. Z-5(D), Z-11(F), Z-16(D)

Response: Observed facilities, which are discussed in the above comment, showed that the furnace cover/hood standard is technically and economically feasible. The energy consumption from this requirement has been considered in the economic analysis and determined to have an insignificant impact. In addition, power consumed for capture and control of the furnace emissions can be reduced by use of hoods that can be positioned closer to the furnace than 6-8 feet or by use of sealed furnace. See also the response to comment 5.

8. Paragraph (3)(ii) should be modified to consider "blowing taps" which are not a malfunction, failure of the process equipment, or failure of the process to operate normally and thus not exempted from this standard by the provisions of §60.8(c) (38 FR 28564). EPA should observe a "blowing tap" before a standard on the tapping station is promulgated. Z-5(D), Z-7(E), Z-11(F), Z-15(D)

Response: Periods during which a "blowing tap" occurs have been exempted from compliance with the tapping station emission capture requirements.

9. Paragraph (3)(ii) requirements do not recognize that hood capture efficiency is affected by the following conditions: (1) a "blowing tap" which will usually persist throughout the entire tap period, (2) poling or lancing of the taphole which causes excessive emissions and may be necessary throughout the entire tapping period, and (3) removal of metal and slag from the spout which may require as much time as the tapping period. Emissions exiting from the building as a direct result of the above conditions will average 40 percent opacity. Paragraph (3)(ii) therefore should be rewritten to allow emissions from the building during tapping periods to average 40 percent opacity. Z-5(D), Z-7(E), Z-9(D)

Response: According to available data on roof monitor emissions, the suggested standard of 40 percent opacity on emissions from the building would permit very poor capture of furnace and tapping fumes. The existence of other emission sources and/or a mixture of old and new furnaces within the building would make enforcement of this standard difficult. Blowing taps are exempted from the requirements of proposed §60.262(a)(3)(ii) [§60.262(a)(5)] because this is a process malfunction condition which is not wholly preventable. Periods in which the tapping hood is swung aside for poling/lancing or removal of metal or

slag from the spout are failures of the process to operate in a normal or usual manner. As malfunctions, these periods are not subject to the standards. All poling or lancing operations which can be conducted with the tapping hood in place are subject to the capture requirements. Emissions from normal polings or lancing of the tap hole were considered in the development of the standard.

10. Enforcement of the provisions of paragraph (3)(ii) will be difficult because the tapping stream is highly radiant thus making observation difficult. In addition, shop conditions can further complicate observation of the tap. Z-11(F)

Response: The tapping station requirement is supported by observations of one tap hood during two tapping periods. Enforcement of this provision will not be complicated by shop conditions. EPA engineers have observed and evaluated the collection efficiencies of tapping hoods at eight ferroalloy facilities in the U. S. and Japan. In none of these facilities did shop conditions preclude evaluation of the capture efficiency of the hood. Neither is the radiance of the molten metal a factor in the assessment because the observer is looking at the tap hood above the molten metal, not the metal. Further evidence of the lack of a problem from the radiance of the metal is workers in the tapping area do not use dark glasses to improve vision or to protect eyesight.

11. Paragraph (3)(iii) should be amended to allow greater than 10% opacity for periods not in excess of one minute to account for unavoidable puffs. Z-6(D), Z-7(E), Z-9(D)

Response: The standard recommended by the commentator is not supported by the available opacity data. Observation of dust handling equipment in the steel and asphalt industires found no visible emissions are associated with the system. The 10 percent opacity standard on dust handling equipment is sufficiently greater than observed values so that a time exemption is not necessary.

12. The provisions of paragraphs (3)(i) and (ii) exceed EPA's statutory authority. The fact that some emissions may escape the building does not confer jurisdiction which otherwise does not exist to regulate emissions within that building. EPA can exercise its regulatory authority over these emissions when they escape into the air. Z-6(D), Z-7(E), Z-11(F), Z-13(C), Z-17(D)

Response: It is the opinion of the Office of General Counsel of EPA that the within the building regulations are within the statutory authority of the Clean Air Act. Section 111 of the Act does not make direct discharge of the pollutant into the atmosphere an express or implicit requirement for regulating the emissions. The intent of the within the building regulation is to ensure that the industry installs efficient hoods to capture the voluminous emissions during ore reduction and tapping operations of a ferroalloy furnace. This only practical way of ensuring this is to restrict the amount of visible emissions escaping capture by the hood.

13. The within the shop opacity standards should be replaced with a zero equivalent opacity standard on the shop roof to facilitate delegation of enforcement authority to States. Most State's air pollution control legislation limits enforcement of standards to the air outside of the working area. Z-1(A)

Response: EPA disagrees that shop opacity standards would be a better method of regulating these fugitive emissions. Other emission sources and activities within the building can cause visible emissions from the shop. An opacity standard on the shop roof is impractical because of emissions from non-regulated activities and sources within the shop and intermingling of emissions from existing and new furnaces in the same building. Since the vast majority of new furnaces will be installed in buildings with other emission sources and/or existing sources, a shop opacity standard could seldom be enforced.

The Office of General Counsel of EPA believes that enforcement authority for the within the shop standards can be delegated to states. States delegated enforcement authority for standards of performance would be operating under the authority of the Clean Air Act, not under the authority of the respective state act. Therefore, the state air pollution control agency can be delegated enforcement authority without modification of existing legislation.

14. The proposed shop standards are impractical, unnecessarily complicated, and not subject to any standard of objective measurement. It cannot be argued that the emissions would be invisible when exiting the building since in that case the emissions could not be considered to be a significant source of pollution. Z-13(C)

Response: The intent of the within the building regulation is to ensure adequate capture of all emissions generated by the operation of the ferroalloy furnace. The direct method of accomplishing this intent is to control emissions at the point of generation where it is easier to control rather than after substantial dilution has occurred. It is more difficult and expensive to collect these emissions after they escape from the furnace area. Emissions from shops containing poorly or uncontrolled ferroalloy furnaces and tapping stations are highly visible. These emissions may vary from 0 to 100 percent opacity depending on the production processes occurring at the time and the capture efficiency of the hoods.

EPA believes that these standards are no more complicated or impractical than any other standards of performance. Assessment of compliance with the no visible emissions escaping the control device requirements is easily accomplished by an observer with a stopwatch. Since the threshold of visibility varies within a narrow range, different observers can objectively assess the performance of the capture hood. The promulgated regulation also includes requirements for monitoring of flow rates through the hood exhaust ducts. Proper operation and maintenance of the hoods will be determined from the flow rate data. The monitoring requirements will make the hood capture requirements more enforceable on a day-to day basis.

15. The inside the shop opacity standards make use of a building evacuation type control system impractical. This approach for controlling fugitive emissions should not be eliminated accidentally by a standard designed to require control of fugitive emissions by an alternative approach. Z-15(D)

Response: Neither the proposed nor the promulgated regulations precluded use of a building evacuation control system. The regulations define "control system" such that for a building evacuation system the entire building is considered to be the control system. The no visible emissions restrictions, therefore, would be applicable to the entire building. EPA believes that use of building evacuation systems will be very infrequent because of the large air volumes that must be exhausted to achieve effective control, and acceptable working conditions.

16. The within the shop visiblity standards are based on an extremely subjective judgment which depends on shop conditions and the observer. Z-5(D), Z-11(F), Z-13(C)

Response: Visibility conditions in well-controlled ferroalloy production facilities are very similar and are very good. Thus, particulate matter escaping capture by the hood is readily observable in all cases. Variations among shop conditions will not significantly affect the observers' ability to assess the performance of the capture hoods. The variation between the ability of unbiased observers to detect visible emissions should be minimal.

17. The within the shop opacity standards will require modification of Method 9 to allow taking of such observations. Z-4(A)

Response: The within the shop no visible emission requirements do not require modification of Method 9 to allow such a determination. Opacity levels of emissions are not being assessed within the building, therefore, the criteria of Method 9 are not applicable to this determination.

18. What type of instruments are being excluded by the phrase "...shall not be visible without the aid of instruments"? Z-8(A)

Response: The intent of this phrase is to limit assessment of compliance to the unaided eye of the enforcement official, except use of eyeglasses is permissible. Use of instruments of any kind for detecting emissions escaping capture is precluded. An example of excluded instruments is portable transmissometers.

19. The provisions of 60.262(a)(3)(i) will greatly increase capital and operating costs of the collection system. To ensure capture of all emissions 100% of the time would require increasing the air volume by 200% relative to existing volumes used. The pollution associated with the increased electrical power consumption should be considered in determining the overall environmental impact of the furnace cover standard. Z-16(D)

Response: EPA's analysis of the power consumed in achieving compliance with the capture requirement standards does not agree with the commentators conclusions. In their joint study (Engineering and Cost Study of the Ferroalloy Industry, EPA-450/2-74-008), EPA and the Ferroalloy Association agreed on the volumes necessary for effective capture of emissions from the model furnace. These exhaust volumes are greater than those measured at well-controlled facilities. The greatest power consumption required by these conservatively high air volumes is 10% of furnace power for a scrubber controlled open furnace. All other cases were for significantly lower power consumption rates. Actual power consumed due to the standard is expected to be less than 5 percent of the furnace power and overall the standard results in a beneficial environmental impact.

20. The 0.99 lb/MW-hr standard does not allow for the normal deterioration in the fabric filter's performance. The standard should be 1.5 lb/MW-hr. Z-17(D)

Response: The suggested revision of the standard is unnecessary because the emission tests were conducted on well-seasoned fabric filter collectors. Some of these collectors had been in operation for several years. Since these facilities can comply with the standard, any other well-designed and maintained fabric filter collector can comply with the standard.

21. Brief periods of emissions >10 percent opacity should be allowed during transfer of dust from the fabric filter to the dust disposal system. Z-17(D)

Response: The standard limiting emissions from dust handling equipment is based on opacity observations of these operations at steel plants and asphalt concrete plants. No visible emissions (zero percent opacity) were observed at any time. The need for the requested upward revisions is removed further by the revision of Method 9 to base compliance on 6 minute averages of the observations. Thus, the promulgated standard provides sufficient accommodation for an occasional puff of emissions escaping the transfer system.

22. Visible emissions cannot be limited to 40 percent of the tapping period. A more realistic approach to control of these emissions would be to regulate emissions from the roof or to require capture after the emissions have left the tapping station. Z-17(D)

Response: EPA observations of emissions escaping capture by the tapping hood at facilities in the U.S and abroad indicate that the standard is achievable. EPA does not agree that an opacity standard limiting emissions from the shop is more realistic. Standards on shop emissions, suffer from the major disadvantage of intermingling of emissions with emissions from nonregulated sources. Thus, compliance with the standard cannot be determined. Regulating emissions before they intermingle makes evaluation of only the source of interest possible.

23. Furnace and tapping fume hoods are essentially constant rate devices. Fume generation from furnaces and tapping fluctuate considerably. Consequently, capture efficiencies will vary considerably for a well designed hood. Z-18(D)

Response: The standards of performance are based on observations at well-controlled facilities and normal variations in capture efficiencies are already incorporated in the standards.

Section 60.263

1. The allowed 20 percent CO by volume represents an explosion hazard and should be reduced. Z-2(A)

Response: The occurrence of gas streams with CO concentrations of 10-20% (vol.) is unlikely because CO emissions from open furnaces are very dilute (<1%) and closed furnaces are very concentrated (>80%). The intent of this requirement is to force flaring of any gas stream which will support combustion (nominally 12% CO but is a function of the composition of the dilution gases).

Section 60.264

1. Continuous monitors are an unnecessary and costly expense. Observation by the human eye should be sufficient and the monitoring requirement should be deleted. Z-5(D), Z-6(D), Z-7(E), Z-9(D), Z-11(F), Z-17(D), Z-18(D)

   Response: EPA does not agree that continuous opacity monitors are an unnecessary expense. The monitoring requirements are an aid in ensuring that sources which have demonstrated compliance with the applicable standards are properly operated and maintained so as to remain in compliance. The costs of opacity monitors for ferroalloy facilities have been considered and the economic impact has been determined to be insignificant. Observation by the human eye alone is not considered sufficient because surveillance can only be conducted on an infrequent basis.

2. The purpose of the continuous monitoring requirements is not clear. The use of monitors will not decrease the time the malfunction persists because of the existing intensive maintenance procedures of the industry. Z-11(F)

   Response: The purpose of the opacity monitoring requirement is to show whether or not the owner or operator properly operates and maintains the control device. The owner or operator may utilize the provisions of §60.13(i) to petition the Administrator to allow alternative methods of demonstrating that proper operation and maintenance of the control device is conducted on a routine basis. See also the discussion in comment 1 of this section.

3. Meaningful monitoring of baghouse emissions would require use of one monitor per each stub stack or compartment and such extensive monitoring would be very costly. Observation by the human eye should be the monitoring technique employed. Z-15(D)

   Response: The baghouse can be designed to reduce the number of opacity monitors required for meaningful monitoring of emissions. In addition, §60.13(a) allows the owner or operator to petition the Administrator to permit use of fewer monitors than the number of separate effluent gas streams, if it can be shown that emissions can be meaningfully monitored by the suggested procedure. Observation by the human eye alone is not considered sufficient because

surveillance can only be conducted on an infrequent basis.

4. Available opacity monitors are not applicable to many types of control devices such as open baghouses or control devices which have gas streams with condensed water vapor. Z-11(F)

Response: EPA disagrees that an exemption from the opacity monitoring requirements is necessary for open baghouses. The opacity of emissions from pressurized (open) baghouses can be monitored using present instrumentation at a reasonable cost using a number of approaches. These approaches include monitoring of several compartments by a conventional path-length transmissometers, or other approaches. In addition to monitoring schemes based on conventional pathlength transmissometers, a long path transmissometer could be used on a pressurized baghouse. Transmissometers capable of monitoring distances up to 150 meters are commercially available and have been demonstrated to accurately monitor opacity. The use of long path transmissometers on pressurized baghouses has yet to be demonstrated, but if properly installed there is no reason to believe that the transmissometer will not accurately and representatively monitor emissions. The best location for a long path transmissometer on a pressurized baghouse will depend on the specific design features of both; therefore, the location and monitoring procedure must be established on a case-by-case basis and is subject to the Administrator's approval.

Control systems which have condensed water vapor in the effluent gas stream may be exempted from the opacity monitoring requirements by §60.13(i)(1).

5. Maintenance and operating costs of the opacity monitors are excessive, especially for small firms. Z-11(F)

Response: The costs for continuous monitoring of opacity were considered in the economic analysis and the economic impact was determined to be insignificant. The capital and operating costs for the opacity monitor are less than one percent of the total capital and operating control costs for the model furnace installation. This requirement is not discriminatory against small firms because the monitoring costs are insignificant for both large and small ferroalloy firms.

6. The time period for reporting of emissions should be increased. One minute is too short a time period in which to take corrective measures. Z-6(D), Z-7(E), Z-17(D)

Response: The reporting requirements have been changed to require reporting of all 6-minute periods where the average opacity exceeds 15 percent.

Section 60.265(b)

1. This paragraph is unclear as to whether the power is measured on the input or output side of the transformer. If the power loss is considered in the power input there will be a slight decrease in the allowable emissions. Z-2(A)

Response: These provisions have been clarified to specify that the power is measured as kilowatts and may be measured either at the input or output side of the transformer. Since the emission rate is partially determined by the power applied to the electrodes, it is this power rate that should determine the allowable emissions from the facility.

Section 60.266(e)

1. C_s should be expressed in terms of Kg/dscm, not Kg/dcm. Z-2(A), Z-6(D)

Response: Agreed. The typographical error has been corrected.

Section 60.266(f)

1. The dimensions for E do not work out to Kg/MW-hr. Shouldn't L_n be expressed in terms of Kg/hr? Z-2(A), Z-6(D), Z-14(B)

Response: Agreed. This typographical error has been corrected.

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Appendix A

Summary of Emission Data Received

In Response to Section 114 Letters

This appendix summarizes the emission test results received from the ferroalloy industry in response to letters, sent under the authority of section 114 of the Clean Air Act, requesting data on well-controlled facilities. Data from five facilities were received in this survey. A brief description of the facilities tested and the emission test procedure is also provided.

Description of Facilities

M2. Open, 7-9 MW capacity electric submerged arc high carbon ferrochrome furnace. Furnace load during tests was 7.3 MW. The air pollution control system consists of a furnace hood (close fitting) and an Aronetics* two phase jet scrubber. Scrubbing water was supplied at 172 liters/min. Tested by EPA using Method 5.

AA. Open, 19-21 MW capacity electric submerged arc silicon metal furnace. The air pollution control system consists of a furnace hood, a separate tapping hood, a set of hairpin radiative gas coolers, and an open pressure baghouse with a monitor discharge. Emissions from the furnace and tapping hood are controlled by the baghouse. Tested by company using a Method 5 type train and an "out-of-stack" Gelman* filter, and sampled at superisokinetic rate. At time of test baghouse operating at lower than design air-to-cloth ratio because only one of two furnaces operating.

BB. Open, 21 MW capacity electric submerged arc silicon metal furnace. The air pollution control system consists of a furnace

* Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Agency.

hood, a tapping hood, and an open pressure baghouse with a monitor discharge. Emissions from both the furnace and tapping hood are controlled by the baghouse. Tested by the company using a Method 5 type train and an "out-of-stack" Gelman* filter, and sampled at a superisokinetic rate.

CC. Open, 19 MW capacity electric submerged arc silicon metal furnace. Furnace load during the tests was 15 MW. The air pollution control system consists of a furnace hood, a separate tapping hood, and an open pressure modular baghouse with individual monitors discharge. Furnace and tapping emissions are controlled by the baghouse. Tested by company using a high-volume modified Method 5 type train with four-inch sampling nozzles. Samples were collected at the center of each compartment at an isokinetic sampling rate for the sampling site. During the emission test the open grates at the cell plate were blocked off (at least partially) so no diultion air would enter the baghouse during the test.

DD. Open, 18 MW electric submerged arc 75 percent ferrosilicon furnace. The air pollution control system consists of a furnace hood, a tapping hood, and an open pressure baghouse with a monitor discharge. Emissions from both the furnace and tapping hoods are controlled by the baghouse. Tested by baghouse manufacturer using high volume samplers in three of nine compartments. For the period of the emission testing the open grates at the cell plate were blocked off so no dilution air would enter the compartments during the test.

* Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the Agency.

EE. Open, 25-30 MW electric submerged arc silicon metal furnace. Furnace load during the tests was 27.4 MW. The air pollution control system consists of a furnace hood with refractory lined doors (or flaps), a separate tapping hood, and an open pressure baghouse with a roof monitor discharge. Emissions from both the furnace and tapping hoods are controlled by the baghouse. Inlet gas volume measurements conducted by company to verify the collection system were within range of design parameters.

Table 1

Facility N2

Chromium Mining and Smelting Corporation

Furnace No. 23

Run No.	1	2	Average
Date	6/26/74	6/27/74	
Test time, min.	360	360	360
Average Power Input, MW	7.30	7.38	7.34
Stack Effluent			
Flowrate, DSCFM	10,911	7260	9086
Temperature, °F	141	147	144
Water Vapor, Vol. %	22.87	20.42	21.65
Particulate Emissions			
Probe and Filter Catch			
Conc. gr/dscf	0.01	0.007	0.0085
Emission rate, lb/hr	0.94	0.44	0.66
kg/hr	0.43	0.31	0.37
lb/MW-hr	0.13	0.06	0.09
kg/MW-hr	0.06	0.03	0.045

Table 2

Facility AA

Interlake, Inc.

Beverly, Ohio

	Average
Date	7/17/72
Average Power Input, MW	Unknown
Stack Effluent	
Flowrate, DSCFM	192,020
Temperature, °F	217
Water Vapor, Vol. %	-
Particulate Emissions	
Conc., gr/dscf	0.0009
Emission rate, lb/hr	3.7
kg/hr	1.68

Table 3

Facility BB

Interlake, Inc.
Selma, Alabana

Run No.	1	2	Average
Date	10/29/75	10/30/75	
Test time, min.	180	240	210
Average Power Input, MW	21	21	21
Stack Effluent			
Flowrate, DSCFM	124,866	-	-
Temperature, °F	240	215	228
Water Vapor, Vol. %	3.0	3.0	3.0
CO_2, Vol. %	0.1	0.2	0.2
O_2, Vol. %	20.1	20.2	20.2
CO, Vol. %	0.2	0.2	0.2
Particulate Emissions			
Probe and Filter Catch			
Conc., gr/dscf	0.00049	0.00052	0.00050
Emission rate, lb/hr[a]	0.68	0.68	0.68
kg/hr	0.31	0.31	0.31
lb/MW-hr	0.032	0.032	0.032
kg/MW-hr	0.015	0.015	0.015

[a] Calculated assuming no di ution air added by dampers or around bags.

Table 4

Facility CC

Kawecki Berylco Industries, Inc.

National Metallurgical Division

Springfield, Oregon

Run No.	1	2	3	Average
Date	10/1/75	10/1/75	10/1/75	
Test time, min.	83	83	83	83
Average Power Input, MW	15	15	15	15
Stack Effluent				
Flowrate, DSCFM	134,300	120,800	141,000	132,033
Temperature, °F	220	229	233	227
Water Vapor, Vol. %	-	-	-	-
Particulate Emissions				
Probe and Filter Catch				
Conc., gr/dscf	0.0024	0.00214	0.00189	0.00214
Emission rate, lb/hr	2.76	2.22	2.28	2.42
kg/hr	1.25	1.01	1.03	1.10
lb/MW-hr	0.184	0.148	0.152	0.149
kg/MW-hr	0.083	0.067	0.069	0.073

Table 5

Facility DD

International Minerals & Chemical Corporation

Tennessee Alloy Company

Kimball, Tennessee

Run No.	1	2	3	Average
Date	4/9/74	4/9/74	4/10/74	
Test time, min.	60	60	60	60
Average Power Input, MW	18	18	18	18
Stack Effluent				
Flowrate, DSCFM	138,200	138,400	131,400	136,000
Temperature, °F	>200	>200	>200	>200
Water Vapor, Vol. %	-	-	-	-
CO_2, Vol. %	1.7	1.3	1.8	1.6
O_2, Vol. %	-	-	-	-
CO, Vol. %	-	-	-	-
Particulate Emissions				
Probe and Filter Catch				
Conc., gr/dscf[a]	0.00029	0.00025	0.00021	0.00025
Emission rate, lb/hr	0.34	0.29	0.23	0.29
kg/hr	0.154	0.132	0.104	0.132
lb/MW-hr	0.019	0.016	0.013	0.016
kg/MW-hr	0.009	0.007	0.006	0.007

[a] Values are not correct but report contained insufficient data to correct values.

Table 6

Facility EE

Union Carbide Corporation

Metals Division

Alloy, West Virginia

	Average
Date	-
Test time, min.	-
Average Power Input, MW	27.4
Stack Effluent	
Furnace, DSCFM	275,000
Taphole, DSCFM	40,000
Temperature[a], °F	350

[a] Inlet to cooler

Appendix B

Six Minute Average Opacity

Values

Facility C

Visible Emissions: Six minute opacity average*

Plant: Ferrosilicon open electric submerged arc furnace

Company Name: Kurreka Seitetsu Company Ltd.

Plant Location: Toyama, Japan

Date: 10/11/73 Time: 2:15 p.m.-4:02 p.m.

Type of Discharge: Stack

Type of Control: Two parallel settling chambers in series with baghouse

Stack Diameter: Stack #1 2.87 meters (9.4 feet)

Stack #2 2.90 meters (9.5 feet)

Stack #3 2.99 meters (9.8 feet)

*Calculated from reading at one minute intervals

Period (6 minute average)	Stack #1 (% opacity)	Stack #2 (% opacity)	Stack #3 (% opacity)
1	5.8	5.0	5.0
2	9.2	6.7	6.7
3	5.8	5.0	5.0
4	5.0	4.2	5.0
5	6.7	5.8	5.8
6	6.7	5.0	6.7
7	3.3	4.2	3.3
8	2.5	3.3	3.3
9	5.0	5.0	5.0
10	5.0	5.0	5.0
11	5.8	5.0	5.0

10/11/73
2:15p.m.-4:02 p.m.

Period (6 minute average)	Stack #1 (% opacity)	Stack #2 (% opacity)	Stack #3 (% opacity)
12	6.7	6.7	7.5
13	5.0	5.0	5.0
14	5.0	5.0	5.0
15	5.0	5.0	5.0
16	3.3	3.3	5.0
17	4.2	5.0	5.0
18	5.0	5.0	5.0

Facility O

Visible Emissions: Six minute opacity averages(*)

Plant No. 9: Ferrochrome silicon open electric submerged arc furnace

Company Name: Airco Alloys and Carbide

Plant Address: Niagara Falls, New York

Date: 2/20/74

Types of Discharges: Baghouse monitor, building roof monitor

Type of Control: Baghouse

*calculated from readings at thirty second intervals

Baghouse Monitor
2/20/74
Time: 9:35 a.m. - 1.35 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
1	0.0	0.0	
2	0.0	0.0	
3	0.0	0.0	light snow
4	0.0	0.0	
5	0.0	0.0	
6	0.0	0.0	
7	0.0	0.0	
8	0.0	0.0	
9	0.0	0.0	
10	0.0	0.0	
11	0.0	0.0	
12	0.0	0.0	
13	0.0	0.0	
14	0.0	0.0	
15	0.0	0.0	
16	0.0	0.0	
17	0.0	0.0	
18	0.0	0.0	
19	0.0	0.0	
20	0.0	0.0	
21	0.0	0.0	
22	0.0	0.0	
23	0.0	0.0	
24	0.0	0.0	

Baghouse Monitor
2/20/74
Time: 9:35 a.m. - 1:35 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
25	0.0	0.0	
26	0.0	0.0	
27	0.0	0.0	
28	0.0	0.0	
29	0.0	0.0	
30	0.0	0.0	
31	0.0	0.0	
32	0.0	0.0	
33	0.0	0.0	
34	0.0	0.0	
35	0.0	0.0	
36	0.0	0.0	
37	0.0	0.0	
38	0.0	0.0	
39	0.0	0.0	
40	0.0	0.0	

Facility R

Visible Emissions: Six minute averages

Plant: Ferrochrome-silicon submerged electric arc furnace

Company Name: Nippon Kokan K. K. Toyama Works

Plant Location: Toyama, Japan

Date: 10/3/73 - 10/6/73

Type of Discharge: Flare stack

Type of Control: Two series venturi scrubbers followed by a demister

Stack Diameter: 0.39 meters (1.27 feet)

Period (6 minute average)	10/3/73 1:30-2:30 (% opacity)	10/4/73 10:30-11:30 (% opacity)	10/5/73 11:30-12:30 (% opacity)	10/6/73 10:15-11:15 (% opacity)
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0

Facility S

Visible Emissions: Six minute opacity averages

Plant: Ferrochrome sealed electric submerged-arc furnace

Company Name: Showa Denko K. K. (s)

Plant Address: Toyama, Japan

Date: 10/8/73 and 10/9/73

Type of Discharge: Flare Stack

Type of Controls: Baghouse on furnace

Stack Diameter: 0.39 meters (1.27 feet)

Period (6 minute average)	10/8/73 12:40-12:52 (% opacity)	10/9/73 9:00-10:00 (% opacity)	10/9/73 10:00-11:00 (% opacity)	10/9/73 11:00-12:00 (% opacity)	10/9/73 12:00-12:30 (% opacity)
1	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0
3	rain 81 min.	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	
7		0.0	0.0	0.0	
8		0.0	0.0	0.0	
9		0.0	0.0	0.0	
10		0.0	0.0	0.0	

Facility U

Visible Emissions: Six minute opacity averages

Plant: High carbon ferrochrome tightly hooded electric submerged arc furnace

Company: Awamura Metal Industry Company (u)

Plant Address: Uji City, Japan

Date: 10/10/73 and 10/11/73

Type of Discharge: Baghouse stack

Type of Control: Two parallel banks at cyclones followed by a bag filter

Stack Dimensions: 1.78 x 1.12 meters (5.85 x 3.66 feet)

Bagnouse Stack
10/10/73

Period (6 minute average)	10/10/73 7:00-9:00 (% opacity)	10/10/73 10:30-12:30 (% opacity)	10/10/73 12:30-2:30 (% opacity)	10/10/73 2:30-3:30 (% opacity)
1	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0
10	0.0	0.0	0.0	0.0
11	0.0	0.0		
12	0.0	0.0		
13	0.0	0.0		
14	0.0	0.0		
15	0.0	0.0		
16	0.0	0.0		
17	0.0	0.0		
18	0.0	0.0		
19	0.0	0.0		
20	0.0	0.0		

Baghouse Stack
10/11/73

Period (6 minute average)	10/11/73 8:00-9:45 (% opacity)	10/11/73 10:45-12:45 (% opacity)	10/11/73 12:45-2:45 (% opacity)
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	0.0	0.0	0.0
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	-	0.0	0.0
20	-	0.0	0.0

Facility V

Visible Emissions: Six minute opacity average calculated from readings at thirty second intervals

Plant: No. 9 silicomanganese open electric submerged arc furnace

Company Name: Union Carbide (v)

Plant Address: Alloy, West Virginia

Date: 2/26/74

Types of Discharge: Baghouse monitor, building monitor, capture hood

Types of Control: Baghouse

Baghouse Monitor
2/26/74
10:20 a.m.-1:20 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
1	13.7	11.7	
2	11.7	11.3	
3	8.8	8.8	
4	4.1	4.2	
5	7.0	6.7	
6	4.6	3.8	
7	2.5	2.5	
8	3 7	2.5	
9	4.6	5.0	
10	5.4	5.4	
11	7.0	7.0	
12	13.3	14.2	
13	11.7	10.8	
14	12.7	12.0	
15	15.0	15.0	
16	17.5	16.3	
17	16.7	15.1	
18	15.8	12.9	
19	12.7	12.9	
20	10.0	10.0	
21	6.7	8.3	
22	5.4	6.7	
23	6.7	6.7	
24	5.4	5.0	

Baghouse Monitor
2/26/74
10:20 a.m.-1:20 p.m

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
25	7.0	8.3	
26	5.8	6.3	
27	5.0	5.0	
28	5.0	5.0	
29	8.8	7.4	
30	10.0	10.8	

Baghouse Monitor
2/26/74
1:20 p.m.-4:20 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
31	12.5	15.0	
32	13.3	13.8	
33	14.2	13.3	
34	15.0	12.0	
35	15.8	15.8	
36	14.2	13.3	
37	11.3	10.8	
38	8.3	8.8	
39	9.2	8.8	
40	14.2	15.4	
41	12.1	11.3	
42	11.3	11.3	
43	10.8	10.8	
44	11.3	11.3	
45	12.1	9.6	
46	13.5	9.6	
47	14.2	11.3	
48	10.8	10.0	
49	10.8	10.0	
50	10.0	9.6	
51	10.0	10.0	
52	9.2	9.6	
53	12.5	10.8	
54	9.2	7.9	

Baghouse Monitor
2/26/74
1:20 p.m.-4:20 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
55	7.5	7.9	
56	10.0	10.4	
57	10.0	7.5	
58	7.9	7.9	
59	5.4	7.9	
60	5.8	10.0	

Facility W

Visible Emissions: Six minute opacity averages calculated from readings at thirty second intervals

Plant: No. 7 silicon open electric submerged arc furnace

Company Name: Interlake, Inc.

Plant Address: Beverly, Ohio

Date: 2/22/74

Types of Discharge: Baghouse monitor, building roof monitor

Types of Control: Baghouse

Note: No data were taken for roof monitor discharge due to smoke from another source obscuring roof monitor.

Baghouse Monitor
2/22/74
8:50 a.m. - 2:50 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
1	0.0	0.0	
2	0.0	0.0	
3	0.0	0.0	
4	0.0	0.0	
5	0.0	0.0	
6	0.0	0.0	
7	0.0	0.0	
8	0.0	0.0	
9	0.0	0.0	
10	8.3	5.0	
11	0.0	0.0	
12	0.0	0.0	
13	0.0	0.0	
14	0.0	0.0	
15	0.0	0.0	
16	0.0	0.0	
17	0.0	0.0	
18	0.0	0.0	
19	0.0	0.0	
20	0.0	0.0	
21	0.0	0.0	
22	0.0	0.0	
23	0.0	0.0	
24	0.0	0.0	

Baghouse Monitor
2/22/74
8:50 a.m.-2:50 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
25	0.0	0.0	
26	0.0	0.0	
27	0.0	-	wind shift toward
28	-	-	baghouse cause smoke
29	-	-	from other building
30	-	-	to obscure monitor
31	-	-	
32	0.0	0.0	
33	1.2	0.8	
34	0.0	0.0	
35	0.0	0.0	
36	0.0	0.0	
37	0.0	0.0	
38	-	-	
39	-	-	
40	-	-	baghouse obscured
41	-	-	by smoke
42	-	-	
43	0.0	0.0	
44	0.0	0.0	
45	0.0	0.0	
46	0.0	0.0	
47	0.0	0.0	

Baghouse Monitor
2/22/74
8:50 a.m.-2:50 p.m.

Period (6 minute average)	Observer A (percent opacity)	Observer B (percent opacity)	Comments
48	0.0	0.0	
49	0.0	0.0	
50	-	-	
51	0.0	0.0	
52	-	-	
53	-	-	baghouse obscured
54	-	-	by smoke
55	0.0	0.0	
56	0.4	0.0	
57	0.0	0.0	
58	-	-	
59	-	-	baghouse obscured
60	-	-	by smoke